American Machinist

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Problems in MACHINING Astronomical Telescope Parts—I

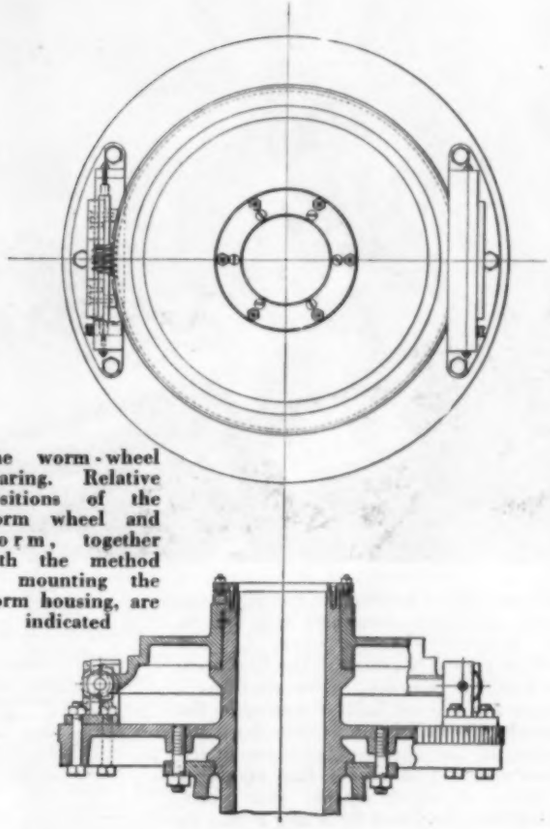
Lapping the worm wheel in on its bearing is done in the usual way with oil and abrasive dust. The wheel is ground simultaneously to a fit both on the tapered stud bearing surface and the solid shoulder which holds it against end movement

Unusual precision requires unusual methods and equipment. Here are shown some of the methods and equipment for attaining it at the Zeiss Works, Jena, Germany. A series of articles on the design phases of astronomical instruments, by the same author, will appear shortly in *Product Engineering*. Devices and methods described here are the creations of Dr. F. Meyer, Chief Engineer in charge of astronomical design at the Zeiss Works

Henry Simon

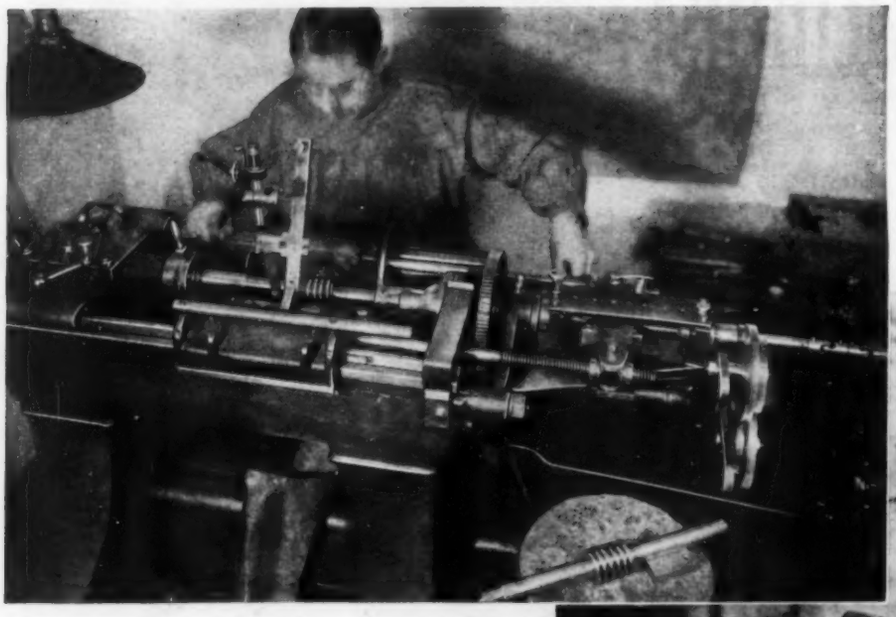
ASTRONOMICAL engineering is remarkable for combining ultra-precision with huge size and weighty mass. For example, the single worm wheel that revolves a telescope once in 24 hours around the polar axis requires several hundred hours merely for the operation of cutting the teeth. Jobs requiring no less accuracy are the worm-wheel driving worms, operations on which will be described in detail. Two other operations, lapping in the main worm-gear bearing, and aligning the worm with the worm wheel, will first be discussed.

Since the slightest play or undue resistance between the worm wheel and worm would disturb the performance of an instrument that must sweep over each successive second of arc in exactly a second of time, it is



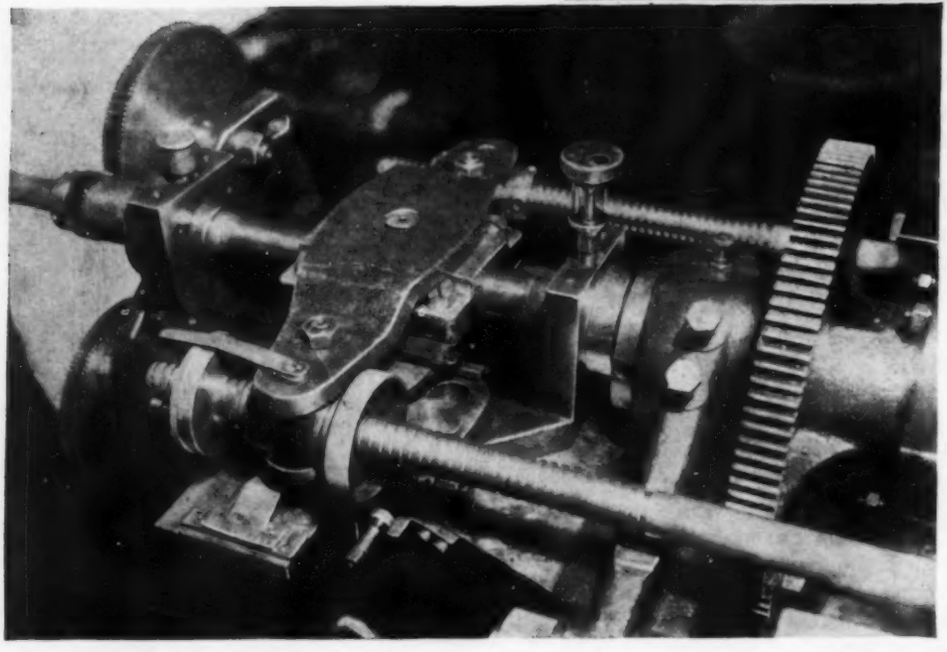
The worm-wheel bearing. Relative positions of the worm wheel and worm, together with the method of mounting the worm housing, are indicated

First of two articles by Mr. Simon. The second will appear in the next number.



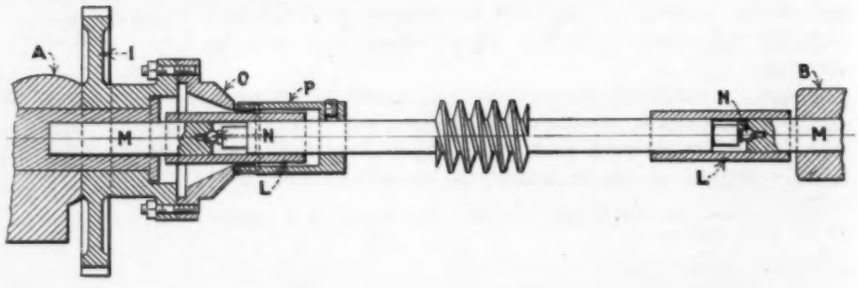
The special lathe for turning worms for the telescope polar drive. The centers of the headstock and tailstock are in a plane with the registering surface of the ways. The carriage is trough-shaped to miss the worm and make room for the cutter slide

Locating the worm. The worm has been set and bolted, and dowel holes are being transferred from the housing to the hour circle flange

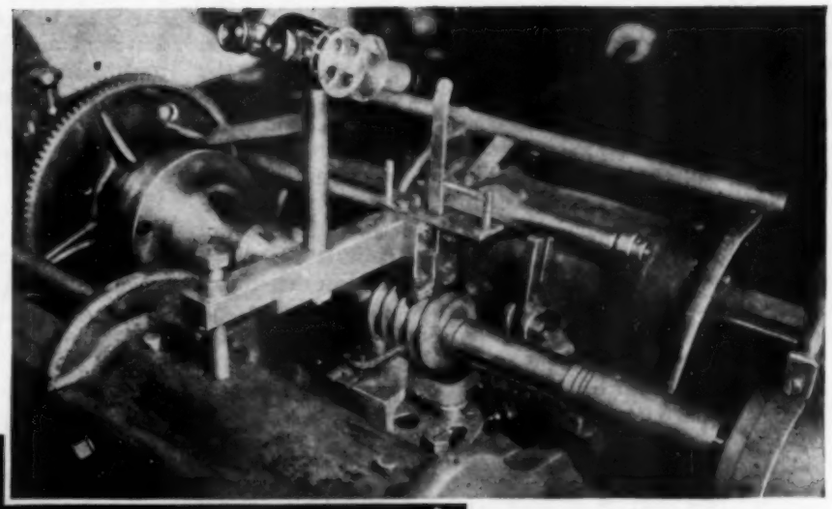


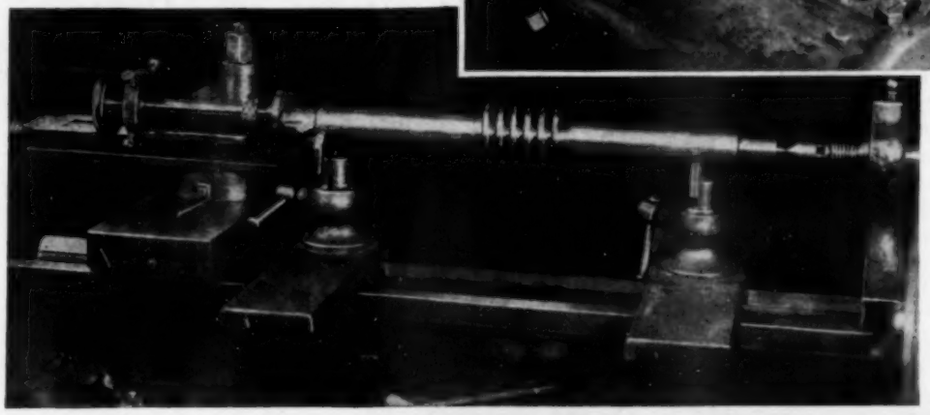
The head end of the lathe. Motion to the cutter is transmitted by the two outside rods held adjustably in knuckles pivoted in a rocking equal-armed lever straddling the nut of the central lead screw. There is no spindle in the ordinary sense. The work is revolved directly from the spur gear at the right, running on a stud on the headstock bracket and driven over a gear train from the lead screw

The method of holding and driving the work. The two wormshaft ends run in two stationary bearing boxes *L*, each held on a stud *M* seated in the headstock bracket and tailstock. Each stud has a center for a steel ball *N* having a flat whereby the ball bears against the plane surface of the hardened end pin in the worm shaft. Fast on the face of gear *I* is driver *O*, which reaches over box *L* and drives the worm by a dog *P* fast on the forward end of the wormshaft



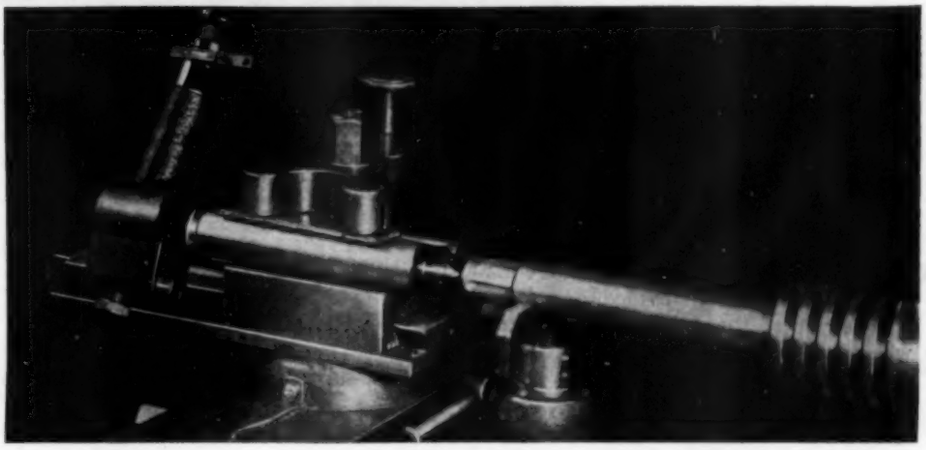
The central portion of the lathe, showing the carriage, cutter, and the combination microscope and indicator swung into position. The indicator utilizes a foil-spring pivot in the vertical lever at the bottom. The top of this lever carries a circular hairline scale so set as to allow of being read through the microscope. The center horizontal plate limits the movement of the vertical lever and also carries posts for attaching the lever tension spring at one side or the other, as one or the other thread flank is examined





Inspecting the worm-shaft end surfaces with an Optimeter clamped on the lapping wheel slide. By leaving the worm at rest and traversing the Optimeter across the pin face, any deviation of the end surface from the plane will be detected

Set-up for squaring worm-shaft ends. Two adjustable stands, each carrying a bronze V, mounted on a precision lathe bed, support the wormshaft by its lateral bearing surfaces. At the right, the hardened thrust pin is rested against a ball center. The tool slide at the left carries a face-lapping disk. Lapping is done by reciprocating the lapping wheel while slowly revolving the work by hand



necessary both to maintain the minimum practical bearing clearance within minimum limits, and to insure exact concentricity of the bearing surface with the teeth in the gear. These conditions are fulfilled by lapping the blank worm wheel in on its pivotal stud, and using this identical part as the stud in the gear-cutting machine.

Lapping in the worm wheel is of interest when considered in connection with the design of the bearing, whereby the wheel is ground simultaneously to a fit both on the tapered stud bearing surface and on the solid shoulder which holds it against end movement. By this combination of design and procedure, the desired objects of concentricity and immovability in any but the circumferential sense is attained. Though unsuitable for ordinary production, this direct method insures a degree of positive accuracy which would be practically impossible with any other method.

The succeeding gear-cutting operation on the worm wheel is performed in a special machine, which forms the 360 teeth in one rough and one finishing cut by the use of a single-point tool. In the worm wheel for a large telescope, this operation requires something like 600 working hours, and the resulting accuracy has no parallel outside of astronomical engineering.

Contrary to ordinary practice, the worm threads when first made have no allowance for bottom clearance. Instead the worm is shaped so that when the center tooth exactly fits the corresponding gash in the worm wheel, the top of the worm thread bottoms in the gash. It is while in this condition that the worm is located relative to the wheel. To insure permanent alignment with the worm wheel without play, the worm runs in a broad-footed housing, and the flange upon the plane surface of which the worm housing is seated, is in one

piece with the bearing stud. Because of the high precision in dimensions and form of the worm threads and the teeth in the worm wheel, bottoming the worm in the wheel is equivalent to locating it in its positively correct position relative to the wheel.

Any adjustment for height is conveniently effected by "floating" the bearing carrier in the outer frame. With the height set and the radial distance gaged automatically, all that remains is to clamp the worm housing in place on the hour flange by means of its three bolts, and to transfer several holes already drilled in the worm-housing foot to the hour flange for the dowels that will maintain the worm in its final position. After the worm has been fitted, it is removed and a small amount is turned off the top of the threads to provide the necessary working clearance.

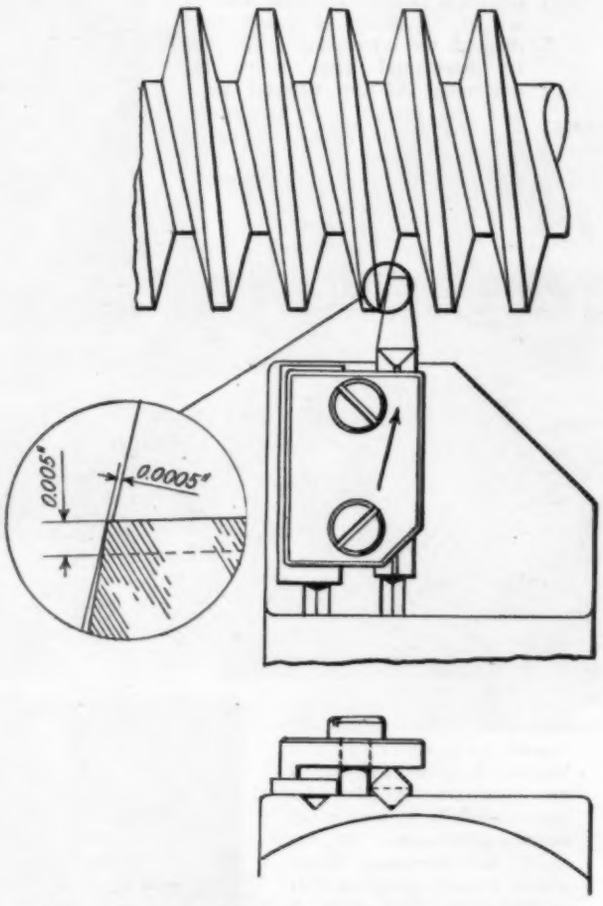
Ultra-Precision

Ultra-precision is obtained in generating the worm thread through strictly logical measures, without dependence upon unusually sensitive or difficult parts. The worm thread is first rough-formed by ordinary methods to within 0.010 in. of its final shape. It is then transferred to the special lathe shown. Though somewhat less convenient to handle than the ordinary lathe, this tool has the vital advantage of doing away with potential sources of error in ordinary lathes. First, all parts concerned in the longitudinal travel of the cutter are placed in a single plane coinciding with the axis of the product. Second, the lead screw is coaxial with the product, and motion is transmitted from it to the cutter by a balanced pull from both sides of a practically symmetrical carriage. Complementing these extraordinary measures for freeing the lathe from basic errors, optical precision means are provided right on the carriage for checking the work at any stage of its progress.

Apart from its location, the lead screw is unusual because of its slow lead, there being something like 24 threads per inch. The lead screw is the most delicate part of the entire lathe assembly and one of the few showing exceptional precision. As will be noted, the lead screw runs in a long nut, and it must be clear that with the conditions provided, any even slightly one-sided pull is out of the question. Like the worm, the worm wheel is guided in machining by the surfaces that will form its bearing later on. It is centered by one set of parts corresponding to the box bearings, and is held against axial movement by another set of parts corresponding to the thrust bearings in the worm frame.

The cutter is ground to slightly less than the angle of the worm thread, and is sharply squared at its end. Cutting is done from start to finish by a succession of extremely fine shavings, each cut entering the flank to a depth of only a few ten-thousandths, and having an infeed of about five-thousandths. At this rate, several days are required before both thread flanks are completed. It goes without saying that, with such a procedure, no appreciable amount of heat is generated, and hence there is no possibility of a change of form from heat expansion.

One thread flank is completed in this manner, and the worm then reversed and the other flank turned. No special finishing operation is employed, but the work left as it comes from the last cut. It is well to observe that although a precision gear is today hardly ever thought of as being otherwise than hardened and ground, these worms go far beyond the range of what is ordinarily understood by precision. Such super-precision is better obtained by the cutting action of a sharp-bladed tool than with an abrasive wheel which will wear as it cuts. Since the worms are required to make but a few thousand revolutions a year against a small resistance, there is no possible object in foregoing the advantages of cutting them in soft metal.



The cutter is held rigidly in a compound rest advanced by a knurled handle visible in the photographs. Cutting is done in the manner shown in the enlargement

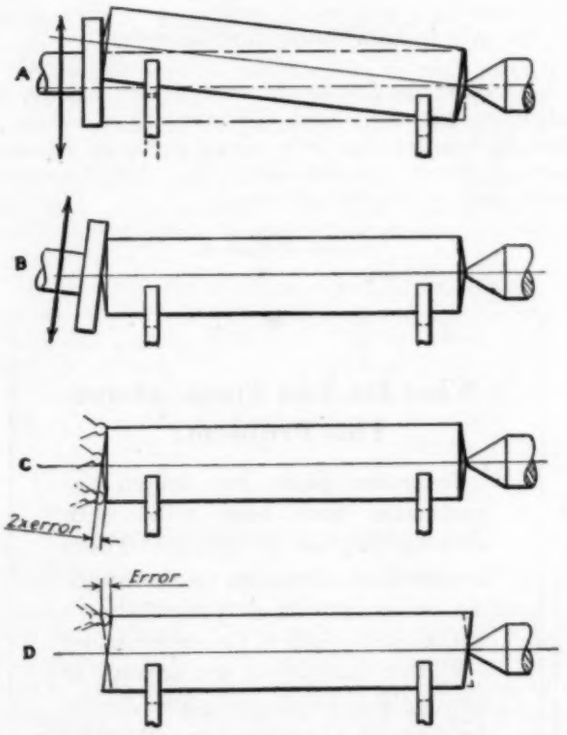
The means used for checking the work consist of a combination of an indicator and a microscope, so mounted that it may be swung into position at any time. The leverage ratio of the indicating lever is about 10:1. Since the microscope magnifies about 60 diameters, this gives a multiplication of 600 times, allowing readings of half-thousandths of an inch, while hundred-thousandths may be estimated. It must be evident from the disposition of the instrument that it is not intended to check the lead of the worm, but only any existing periodic error in individual threads, such as might arise through slight discrepancies in the rotation of the worm or a hard spot in the material. Since the tool point and indicator are 90 deg. apart, any such local error is bound to manifest itself in an oscillation of the indicator scale while the lathe is running. The lead of the worm as a whole, on the other hand, is practically reduced to a function of the lead-screw lead, since the lead-screw axis is coincident with that of the worm and because of the manner in which the motion of the lead-screw nut is transferred to the carriage. A periodic error due to the

lead screw is all but excluded by the large number of threads used in it. With the peculiar design of the lathe and the conditions under which it is used, therefore, a periodic error from causes other than in the lead-screw is the only one which need be considered, and any such error is certain to be revealed by the indicator.

The extraordinary precision of the worm threads would be largely wasted unless effective measures were taken to prevent endwise play of the worm. The means employed to forestall these eventualities depend mainly upon exact squareness of the wormshaft ends. For this reason, the squaring of these ends is of major importance.

Squaring is a lapping process performed when the worm is otherwise finished, though of course prior to the final cutting operation just described, in which the worm must be running on its ultimate bearing surfaces. The lapping is repeated a number of times on alternate shaft ends. Assuming the axis of the worm to be exactly perpendicular to the transverse and face plane of the lap, then it will be clear that the final result will be two end surfaces exactly plane and perpendicular to the worm axis. In the case of any other alternative, the result can be only symmetrical cone-shaped surfaces at either end, which would hold the worm against endwise motion, although they would, of course, be undesirable from the point of view of wear.

As a matter of fact, however, every precaution is taken from the beginning to insure exact alignment. The bearing surfaces of the worm shaft are, of course, precision dimensions, and the distance between them is relatively long. The V's and wheel slide are highly accurate, and are set with extreme care. Thus two plane and parallel surfaces are produced almost every time, and it remains only to verify the result. This is done by means of an Optimeter, the super-precision commercial indicator developed by the Zeiss Works. This instrument allows differential readings to 0.00005 in., but detects differences down to 0.00001 and less. By leaving the worm at rest and traversing the Optimeter across the pin face while the Optimeter body is clamped on the lapping wheel slide, any deviation of the end surface from the plane will be detected. By revolving the shaft with the Optimeter held still, any unsquareness will immediately become manifest. When the Optimeter pointer remains at rest during both tests, evidence is complete that the surface is both a true plane, and perpendicular to the worm-shaft axis.



Paralleling the worm-shaft ends by the means described can at worst produce symmetrical cone-shaped end surfaces as at *A* and *B*. This is shown by moving the Optimeter across the face, as at *C*. Unsquareness with the axis is shown by revolving the worm with the Optimeter held steady as at *D*

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Guessing Cutting Speeds from Other Fellow's Charts

JOHN R. GODFREY

"EDUCATION is a great thing, Godfrey," said Old Man Johnson the other day, "but a lot of people seem to think you can get it all out of books.

"Now I'm not knocking you pen pushers a bit, John R. You're doing a good job on the whole, but you know as well as I do that you can't get the last word on anything about your own kind of business out of some other fellow's book.

"Maybe I ought to tell you what started me off on this tack, Godfrey. Young Bronson came in this morning and wanted a lot of dope on cutting speeds and feeds, and I turned him over to Tom. Tom took him out in the shop and let him see what we're doing, but that didn't satisfy him."

"What I want," says the kid, "is some blueprints and charts that show me how fast cast iron, malleable iron, brass, and other things ought to be cut. We've got a lot of back numbers in our shop, and I know most of our machines don't run fast enough. So I'm going to do some time-study work and speed 'em up a lot. I read about some of these new tools that can cut cast iron at five hundred feet a minute, and that's what we want."

"And of course you told him all about it, Johnson," I ventured.

"I told him plenty, Godfrey, but he didn't soak up more than half of it. I told him you could cut cast iron anywhere from forty to a thousand feet a minute, depending on the kind of iron, the kind of tool, the rigidity of the machine, and the work itself. Tom showed him where we were cutting some at two hundred feet and other work where we cut at forty because the castings were light, and would spring out of shape under the heavier cutting pressure.

"Tom tried to tell him something about the economic life of tools between grinds, but it didn't sink in at all. He thinks you can cut metal with a slide rule and figure out just how long it takes a man to get a drink of water.

"The great trouble with a lot of time-study men and planners is that they don't know a thing about the variables that enter into machine work. They think there ought to be a book or table that tells them just what speed and feed to use in any case. And that's one of the things that raises hob in the shop. They don't know the work and the men know they don't know it."

EXECUTIVE FORUM

Inducing Ideas

A DESK piled high with blueprints and tracings gave mute testimony to the fact that Paul Gilmore was busy. The chief engineer of the Eastside Machine Company was engaged in examining a new layout when Bill Holland entered his office.

"The business depression doesn't seem to affect you," said Bill, surveying the work on his friend's desk.

"It has though," said Gilmore, "by doubling my work. When earnings are rolling in, the company seems willing to coast along with its old designs. But when sales fall off, there is a hurried demand for new ideas."

"Not a bad plan," said Bill. "It's a constructive way to promote new business. Companies that don't take this opportunity to revamp their designs will find they have missed the boat when things start moving again.

"Yes, but it's hard on the poor engineer," said Gilmore. "The designer's pressure curve is the reciprocal of business activity. But he has to get along with the same force if he's lucky and less if he's not. My present problem is to get two men's work out of each draftsman."

"Why not take a leaf from the production man's notebook?" asked Bill. "Inaugurate an incentive system. That should speed up your output."

"I have enough trouble on my hands without looking for more," said Gilmore. "Design and production are entirely different. The shop does the same work or similar work over and over again. That gives some standards of comparison. Here every job is different and is done but once."

"I realize you can't use a straight piecework system," said Bill, "but other plans can be evolved. For example, when quoting on a new job, you have to estimate designing time. Why not credit your men with the amount they better the estimate and pay them a premium accordingly?"

"That might work on special jobs," said Gilmore. "But on our standard line we make no design estimates as the cost is distributed over a large number of machines. It wouldn't do to stress special work by paying a premium for it, to the detriment of our regular product, which in the long run, is far more important. Besides quality counts more than speed."

"Then you might put the plan on a still broader basis," said Bill. "Award a monthly premium to be apportioned among all drawing office employees based on company earnings. That would emphasize the dependence of profit on design and should stimulate a real interest in quality as well as output."

"That plan has too much lag to be effective," said Gilmore. "Some of the designs we're working on now may be used for five years. During that time, we may have many changes in personnel. If the product proves profitable, a lot of men will participate in the premium who never touched the design. Good workers and poor ones would profit alike. Other factors besides design affect profits, so the connection between the two is too remote. My idea of a real incentive is one that is quick, direct, and closely tied in with a man's immediate work. Your plan would raise the level of wages in good times but provide little inducement for greater effort."

"If you are opposed to a general incentive system," said Bill "you could set up a bonus for your chief draftsman and the senior draftsmen. They should set the pace in both quality and quantity."

"A scheme like that would simply foster jealousy and defeat its purpose," said Gilmore. "You'll have to think up a better plan Bill. Bring it around when the plant is busier and I'm not. And then I probably won't need an incentive system."

Suggested by James R. Cornelius, Coventry, England.

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What Do You Think About This Problem?

Incentive plans for design departments have been tried with varying degrees of success. There are obvious obstacles to the application of routine shop methods to the drawing office. However, many feel that incentives are correct in principle and that some way should be devised to make them effective. Do you think incentives for designers are desirable? How can an adequate premium plan be applied to the drawing office?

. . . Discussion
of Executive Problems

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Free Advice

We have always aided our employees as much as we possibly could. If they want to build a house, we offer suggestions and if necessary, financial aid. If they become sick due to causes outside their work, we allow them to use the factory physician at no expense to them. All this is done with the idea of keeping the mens' minds free from worry.

In giving advice, we always try to get their opinion first and then to show the advantages or disadvantages of their plan. An employee in trouble should agree with the employer's suggestions or there will surely be undesirable controversey.

—U. Seth Eberhardt, *Works Manager, Newark Gear Cutting Machine Company.*

Misguided Loyalty?

We cannot prevent our inferiors in rank from sitting in judgment upon us. Their criticisms are allowable among themselves, but not before their superiors or ours. Any executive of experience knows that it is poor policy to solicit from an assistant, criticism of his immediate superior. It is distinctly unethical and disturbs that mutual confidence and respect which should exist between executives.

An assistant works manager will be on thin ice if he exposes his chief, and this action would only be warrantable under extreme pressure. The president, would do better to settle his doubts by dealing directly and tactfully with the manager. No employee should be expected to be at once the critic and assistant of another.

—Hamilton Hyde.

Convenience or Confusion?

The conservative element claims that if America adopts the metric system a large amount of machinery must be replaced. They claim that this is a serious disadvantage, but on the contrary, this is one of the greatest advantages derived from the adoption of this modern system. Most of the equipment and machinery in American factories is primitive, obsolete, and inefficient. Replacing it with modern up-to-date machine tools would put new life in American factories and would greatly expand the production of American machine tool builders. —Frank Schrader.

Brain Fag

One of the most efficient designing departments, I have come in contact with, was controlled by a man of great discernment. He made it a point that on the completion of an important job the person having done this would be sent away for a day or two, to look through factories for the purpose of enabling him to freshen up his brain and partly as a sign of appreciation for the work done. The amount of work turned out from this particular drawing office was colossal, considering the size of the designing staff, and its productions are the wonders of the engineering world at the present time.

I know of another drawing office filled with so many men that an annex has been sought. The man in charge works all day and takes work home; he is over designers in one large room. Their work is mediocre and it takes a long time to do a little bit of work.

It is most important that designers should be treated as responsible men. They should be advised as to the urgency of the work they are engaged upon and allowed their own method and time for getting it finished. If a designer takes a notion to go out for a smoke the chances are he has done this for the purpose of concentrating on a knotty problem. —James Dolittle, *Edgerton, England.*

No Change

"Without just cause," would be the rock on which such a rule would go to pieces. It would take a good size quorum of lawyers to decide what is a just cause.

Compelling a man to stay when he wishes to go would be a restriction unspeakably reactionary and unjust and would only be admissible as an emergency measure during war. Should managers and directors find themselves unequal to accepting this contention, let them interpret it in terms of their own position, and recognize the fact that what is unfair and reactionary for them is equally so for the rank and file of the shops. —J. T. Towlson, *London, England.*

If someone were to specify where manufacturers could sell their products they would resent it and rightly. Why, then, should they try to specify where a man can sell his labor? A more careful selection of men on the part of the employment manager, and a willingness on the part of the management to keep up to or a little above the prevailing wage scale, will do more towards the solution of this problem than any plan like the one proposed.

—Thomas M. Garry, *Apprentice Instructor, Yale and Towne Manufacturing Company.*

Promising Performance

In any machine performance, one must consider certain elements as detracting from the actual maintenance of the cycle. If a check is made of each step and an average taken of the various conditions, we can arrive at a very close approximation to the actual limit of performance of the machine. If we will then allow a certain tolerance of ignorance as to conditions in the shop where the machine will be placed, we can easily set a perform-

ance schedule that could be guaranteed under all conditions.

Samples of parts are nearly always sent to the shop for a trial of the machine, and a check may be made of conditional aids or hindrances. If the guarantee embodies these conditions, it is only fair and honest to give a signed guarantee of the performance. If conditions of shop practice and materials have been considered, our factor of ignorance will enable us to still meet the contract as guaranteed.

—C. G. WILLIAMS, *Chief Engineer, Green Bay Barker Machine & Tool Works.*

Guarantees on equipment sold are always a source of controversy after installation, especially when the equipment is intricate or difficult to adjust. It is quite possible that guaranteed equipment, while not performing within the limits of the guarantee, will still perform better than the older equipment which the customer may have had. In such cases, the enthusiasm induced by the new equipmen may cause him to overlook the fact that the guarantee is not strictly met. I know of one case where the equipment performed far better than any other equipment the customer had known of, and yet he has put the manufacturer to a vast expense in fulfilling his guarantee.

—MAX S. KLEIN.

Lucky Number?

The thirteen-month year would be a good thing in many respects, if adopted by the entire United States. If not adopted universally, it would be very confusing as is daylight saving at the present time.

The thirteen-month year has many advantages. One would not have to stop and think how many days are in each month. It would be easier to compare costs and sales. At the present time, it is necessary to compare this month with the corresponding month last year. The disadvantages are that the present calendar has been in force for hundreds of years, and it would be hard to accustom oneself to a new calendar.

—J. WALTER WRIGHT, *Assistant to the President, Wilmot Fleming Iron & Steel Company.*

Food for Thought

With few exceptions, manufacturers should not open cafeterias, but should leave this line of business to the restaurateur. There are exceptions, as a factory in an isolated location without access to a good eating place. The general excuse in starting a factory lunchroom is that lunches will be served at or below actual cost, and if a lunchroom is operated at a loss, profits from other departments must be used to make up the deficit. This will lower profits and wages; the man carrying his lunch will be helping to feed his fellow-workmen who are buying lunches at less than cost.

Factory lunchrooms are time savers and are mighty convenient for the employees. Management is justified in installing them when conditions warrant, but they should be made to pay their own way. —C. F. STAPLES.

Food for Thought

Lunchrooms or cafeterias operated by a company are business ventures. A lunchroom is a decided asset to a company when food cannot be had in the vicinity of the plant at reasonable prices. When men can obtain wholesome food in clean surroundings, much benefit is derived by the company, directly or indirectly.

Why shouldn't space be allotted to a cafeteria on company property, as well as to locker rooms and wash rooms? All incidental charges should be allocated to it, and whoever has charge should be made to understand that expenses are to be kept down as much as possible without raising prices to such an extent that the lunchroom will not be patronized. If an outside lunchroom can make a profit on the employees business, then the company lunchroom should be able to sell a little cheaper, or furnish better food and pay all expenses. If this is not accomplished, the management should locate the difficulty the same as with one of the production departments. —M. E. ROTCHY, *Celite Corporation, Lompoc, Cal.*

One Big Family

To promote a better understanding between employers and employees is a good policy. Too often employers think only of how much work they can get out of an employee, and employees only of the maximum wages they can extract. The fault with most social schemes is that they are too patronizing. Welfare workers are wanted who can talk to men in the same manner as their mates. Let those who aspire to welfare work have a three-year course in the shop, working as ordinary hands. They will then get to know men as they are, what they like, how they view things, and what interest they want taken and what they do not. —W. E. WARNER, *Herts, England.*

Come Seven?

The human race is always ready for a greater percentage of leisure time. To distribute this time an hour a day will not be so effective as the elimination of work on Saturday mornings. With two full days a week available, men will be able to enjoy their leisure more leisurely. The usual objection to shortening the working day is the fear of having to pay much larger sums for overtime work during boom periods. This objection is coupled with the increase in cost of production through adjusting pay to a shorter day and also the increased overhead resultant from utilizing the capacity of the plant one hour a day less.

It is true that fatigue is a factor in cutting down production. Would it not be possible that the shortening of hours might result in a decrease in fatigue, which would bring production nearly back to that of a longer day? Would this not be particularly true under an incentive system, if a cut in hours were made without adjusting hourly rates, giving an incentive to greater production not only through reduced fatigue but also through the desire of the workman to recoup his lessened earnings. If conditions have improved in industry, should we condemn the machine because of a temporary setback? —W. A. WALTER, *Purchasing Agent, Pneumatic Scale Corporation.*

CORRECTIONS FOR GEAR TOOTH CALIPERS

NIKOLA TRBOJEVICH
Research Engineer, Timken-Detroit Axle Company

MANY of us develop easier and quicker methods to attain certain results and use them for years without making them public. Often this is caused by a desire to assure ourselves that these methods will stand the test of actual usage. The formulas for gear gaging herein described have been applied with success although I have never seen them in print.

When using a caliper for measuring the thickness of gear teeth, corrections must be made in the settings both for the addendum S and the thickness T (Fig. 1). If we denote the corrected dimensions by S' and T' respectively the settings will be:

$$S' = S \pm H \quad (1)$$

$$T' = T - G \quad (2)$$

where H and G are the corrections to be found. S is the true addendum, and T is the arc of the pitch circle subtended by the tooth profiles. The plus sign in Equation 1 applies to external gears, the minus sign to internal gears and gear form cutters.

The corrections G and H may be determined by two simple formulas without the use of trigonometric tables. The advantages of these formulas are that they are easily remembered and are readily solved with a slide rule in a few seconds. While the new formulas are based on mathematical approximation and are therefore not strictly true, the degree of accuracy is so extremely fine that in practical work the results may safely be considered to be closer than those obtained by the use of a five-place trigonometric table.

A further advantage of these formulas is that they are readily applicable to all kinds of standard and special gears. Since they contain no reference to the diametral circular, or module pitch of the gear, they give correct results whether the English or the metric system is employed and whether the thickness of the tooth is equal to half the circular pitch as in standard gears or any other fraction thereof as in long addendum gears or Maag gears.

Referring to Fig. 2, these formulas are derived as follows:

$$H = R(1 - \cos x) \quad (3)$$

$$T = 2Rx \quad (4)$$

$$T' = 2R\sin x \quad (5)$$

From which:

$$G = T - T' = 2R(x - \sin x) \quad (6)$$

Writing the values of $\sin x$ and $\cos x$ in the form of two infinite series:

$$\sin x = x - \frac{x^3}{6} + \frac{x^5}{120} - \cdots \quad (7)$$

$$\cos x = 1 - \frac{x^2}{2} + \frac{x^4}{24} - \cdots \quad (8)$$

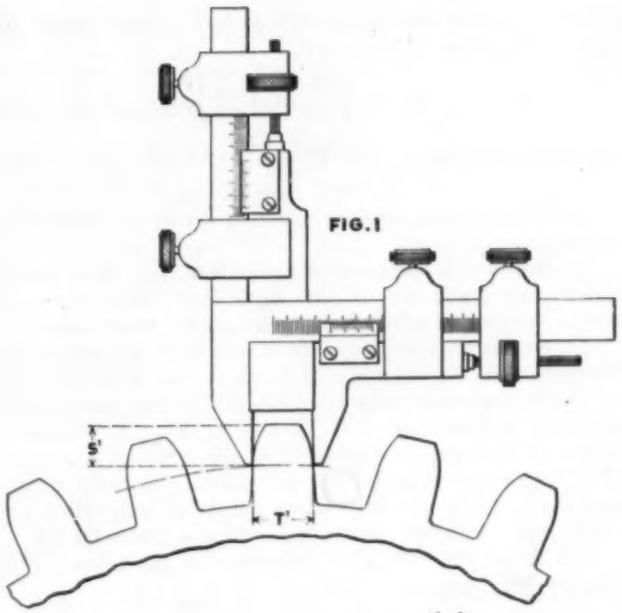

FIG. 1

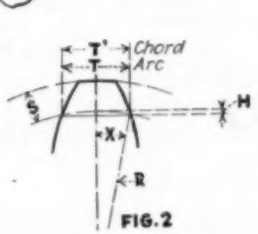

FIG. 2

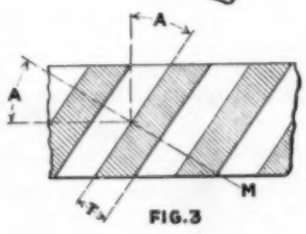

FIG. 3

The third and succeeding members at the right-hand side of Equations 7 and 8 are negligible in comparison with the preceding members because the angle x is always small in gear work. Thus we have from 7 and 8:

$$1 - \cos x \backsim \frac{x^2}{2} \quad (9)$$

$$x - \sin x \backsim \frac{x^3}{6} \quad (10)$$

From Equation 4:

$$x = \frac{T}{2R} \quad (11)$$

And from Equation 3:

$$H = \frac{Rx^2}{2}$$

or

$$\boldsymbol{H = \frac{T^2}{8R}} \quad (12)$$

Similarly from Equations 6 and 10:

$$G = 2R\frac{x^3}{6} \quad (13)$$

And from Equation 11:

$$G = \frac{T^3}{24R^2} \quad (14)$$

Then from 12 and 14:

$$G = \frac{TH}{3R} \qquad (15)$$

Inasmuch as the correction G is small in comparison with correction H, Equation 15 may be still further simplified.

Since: $$T = \frac{\pi}{2D}$$

and $$R = \frac{N}{2D}$$

where D is the diametral pitch and N is the number of teeth. Equation 15 becomes:

$$G = \frac{\pi H}{3N} = 1.05\frac{H}{N}$$

Or approximately: $$\boldsymbol{G = \frac{H}{N}} \qquad (16)$$

These formulas may be summed up in the following statements:

To obtain the addendum correction for spur gears, square the thickness of the tooth and divide by eight times the pitch radius or four times the pitch diameter.

To obtain the chordal correction, divide the addendum correction by the number of teeth in the gear.

These formulas may be used for helical gears after suitable modification. As shown in Fig. 3, the helix angle A is measured relative to the axis of the gear. The measurement of the tooth is taken along the normal helix M. It is therefore necessary to determine the radius of curvature of the helix to use Formula 12.

Let R' be the radius of curvature of the helix. It is known from geometry that:

$$R' = \frac{R}{\cos^2 A} \qquad (17)$$

Then Formula 12 becomes:

$$\boldsymbol{H = \frac{T^2 \cos^2 A}{8R}} \qquad (18)$$

Then it may be stated that:

To obtain the addendum correction for helical gears, square the normal thickness, multiply by the cosine squared of the helix angle and divide by eight times the pitch radius or four times the pitch diameter.

To obtain the chordal correction for helical gears, divide the addendum correction by the number of teeth in the gear.

The question naturally arises as to how accurate these formulas are. Let E denote the error in the addendum correction H. We can then write from Equation 8:

$$1 - \cos x = \frac{x^2}{2} - \frac{x^4}{24} \qquad (19)$$

And from Equation 3:

$$H = \frac{Rx^2}{2} - \frac{Rx^4}{24} \qquad (20)$$

The second member at the right-hand side of the equation is greater than the error actually incurred because the next member in the series would be positive and thus partially balance the second member which is negative. Then:

$$E < \frac{Rx^4}{24} \qquad (21)$$

$$x = \frac{T}{2R} \qquad (22)$$

For a 1 diametral pitch gear:

$$T = \frac{\pi}{2} \text{ and } R = \frac{N}{2}$$

Then $$E < \frac{\pi^4 \cdot 8}{16 \cdot 384 N^3} = \frac{\pi^4}{768 N^3} = \frac{0.127}{N^3}$$

Therefore for even such a large pitch as 1 D.P., the error for a 12-tooth pinion is less than:

$$E < \frac{0.127}{1{,}728} = 0.00007 \text{ in.}$$

For gears with larger numbers of teeth the error is even less. This proves the formulas to be extremely accurate.

The accompanying table shows the values of H and G for standard 1 diametral pitch spur gears computed from Formulas 12 and 16.

$$H = \frac{\pi^2}{16N} = \frac{0.61685}{N} \qquad (23)$$

$$G = \frac{H}{N} = \frac{0.61685}{N^2} \qquad (24)$$

To find these values for any other diametral pitch, simply divide the quantities shown in the table by the diametral pitch desired. It should be noted that the table is correct for only standard tooth thicknesses, that is when they are exactly one-half the circular pitch. If a special thickness is required or if the gears are helical, resort must be made to the original formulas 12, 16 and 18.

VALUES OF H AND G

N	H	G	N	H	G
8	0.07711	0.00964	29	0.02127	0.00073
9	0.06854	0.00761	30	0.02056	0.00069
10	0.06168	0.00617	31	0.01990	0.00064
11	0.05608	0.00510	32	0.01927	0.00060
12	0.05140	0.00428	33	0.01869	0.00057
13	0.04745	0.00365	34	0.01815	0.00053
14	0.04406	0.00315	35	0.01762	0.00050
15	0.04112	0.00274	36	0.01713	0.00047
16	0.03855	0.00241	37	0.01667	0.00045
17	0.03629	0.00213	38	0.01623	0.00043
18	0.03427	0.00190	39	0.01582	0.00041
19	0.03247	0.00171	40	0.01542	0.00039
20	0.03084	0.00154	41	0.01505	0.00037
21	0.02937	0.00140	42	0.01468	0.00035
22	0.02804	0.00127	43	0.01435	0.00033
23	0.02682	0.00117	44	0.01402	0.00032
24	0.02570	0.00107	45	0.01371	0.00030
25	0.02467	0.00099	46	0.01341	0.00029
26	0.02373	0.00091	47	0.01313	0.00028
27	0.02285	0.00085	48	0.01285	0.00027
28	0.02203	0.00079	49	0.01259	0.00026

***H* designates the addendum corrections and *G* the tooth thickness corrections for a 1 D.P. spur gear.**

■

Grease smeared on the inside of a spray booth to keep the lacquer from sticking added considerably to a fire in a Detroit plant, and may have caused spontaneous ignition. It's much safer to use paper sheets, easily destroyed and replaced, or for larger booths a soap solution, applied either by spray gun or whitewash brush.

CIRCULAR FORM CUTTER DESIGN—II

JAMES L. INGALLS

LAST WEEK the author showed that outside diameter, number of teeth, depth of gash, and radial relief were all based directly or indirectly on the form to be milled. The present and concluding article deals with the influence of relief and shape of the form on cutter construction.

A CIRCULAR form cutter may have three kinds of relief: radial, side, and compound which is a combination of radial and side relief. Fig. 1 illustrates how radial relief on a cutter is obtained. The cutter is held on a mandrel which rotates on centers. A form tool, having the required shape of the product and relieved to a cutting edge, travels in and out in a path 90 deg. to the cutter axis. This travel is controlled by a cam on the backing-off lathe. On the in-travel, the tool cuts its form along a secondary curve *MN* and parallel secondary curves as shown. These secondary curves are known as radial relief or heel relief.

Radial relief will give a proper cutting edge on straight surfaces, such as *A* and *F*, on angular surfaces, such as *B* and *C*, or on concave surfaces, such as at *D*. But for a surface such as *E*, 90 deg. to the cutter axis, it will be seen that this method gives no relief. It is therefore necessary to consider three classes of forms:

Case 1. When the form includes no surfaces at 90 deg. to the cutter axis.

Case 2. When the form includes surfaces at 90 deg. to the cutter axis which are all right hand or all left hand.

Case 3. When the form includes surfaces at 90 deg. to the cutter axis some of which are right hand and some left hand.

Form cutters may also be classed as to construction:

Type A. Solid cutters, where one piece carries the entire form.

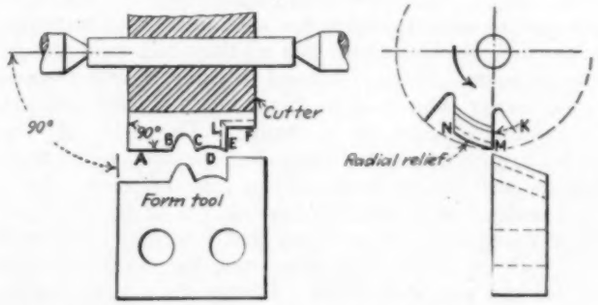

Fig. 1—For surfaces perpendicular to the cutter axis, radial relief is usually insufficient

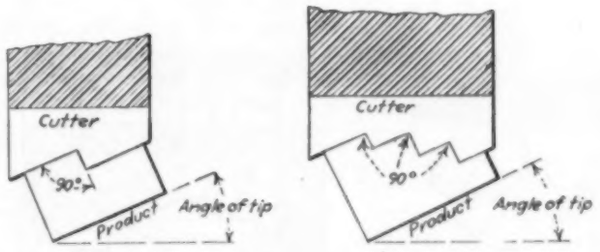

Fig. 2—In some instances, cutter drag may be avoided by tipping the work

Type B. Cutters made in two or more parts, each part a circular form cutter comprising a portion of the form, all interlocking and adjustable.

Type C. Cutters the same as *B* except that they have no adjustability.

Type D. Cutters consisting of two or more parts, some of which are circular form cutters and some standard milling cutters, all interlocking, overlapping, and adjustable.

For Case 1, a solid cutter may always be used, for all surfaces will be relieved properly with radial relief. If the 90 deg. surfaces are comparatively short, the solid cutter may also be used for Case 2, and when kept sharp will give satisfactory results. However, if any doubt exists in the designer's mind as to the advisability of this type, it is wiser to design the tool to obviate this drag on the 90-deg. surfaces for any drag on the cutter may soon ruin it. A very practical method to employ is to make a solid cutter and to tip the product at an angle in the vise jaw or fixture as in Fig. 2. The angle of tip should be as great as possible, other conditions considered. Any angle, however slight, will help relieve the drag, but it is safer to make the angle of tip not less than 5 deg.

For Case 3, if the 90 deg. surfaces are comparatively short, the solid cutter may be used as for Case 2, but the method of tipping the work cannot be used because of the opposed 90 deg. surfaces. The reason is apparent when a rectangular slot is tipped. So if a solid cutter is not wanted, resort must be made to the principle of interlocking cutters. But before considering the design of

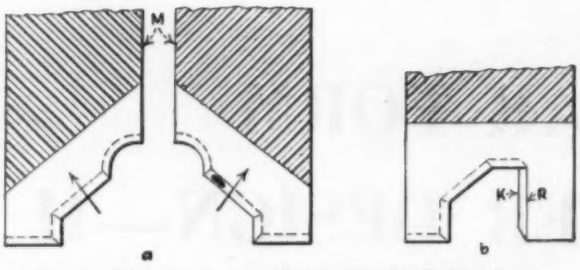

Fig. 3—The correct use of compound relief is shown at *a*; for the closed cutter *b*, it cannot be used

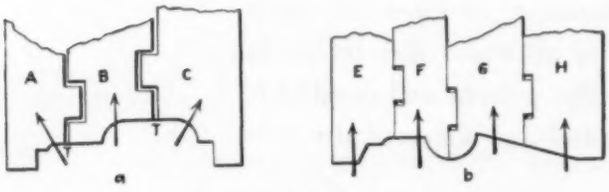

Fig. 4—Types of interlocking cutters showing compound relief *a* and radial relief *b*

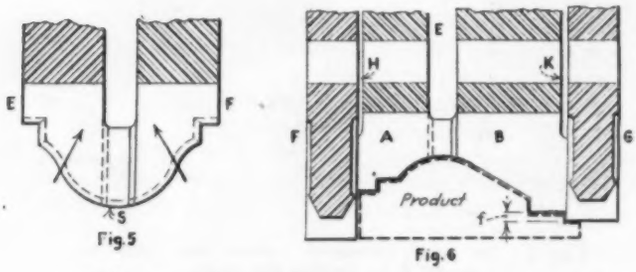

Fig. 5 — Curved contours may prevent the use of adjustable interlocks with compound relieved cutters
Fig. 6—Built-up tools combining special and standard cutters solve many form-milling jobs most economically

this class of tool, side and compound relief will be explained.

Side relief of 90 deg. surfaces on circular form cutters is never used where accuracy of form is to be maintained, for with the 90-deg. surfaces side relieved and the other surfaces radially relieved, the form would change when ground. Referring to Fig. 1, if surface *E* was given side relief to the dotted line *L*, grinding would cause edge *E* to move toward the left while the other edges moved radially. But if in making the cutter, the form tool traveled in a path at 80 deg. to the cutter axis instead of 90 deg., a radial and side relief of all parts of the form would result. This double relief is called compound relief.

Compound relief can only be used on what is termed open forms, see Fig. 3a, and not on closed forms, Fig. 3b. Surface *K* which is the relief for cutting edge *R*, is on the wrong side. The arrows on Fig. 3a indicate the direction the form will travel when grinding the cutter. When the two parts of the cutter have been ground the width of the form will increase. To bring the two parts back into their original relative positions, they must be ground on the seating surfaces *M*. But to eliminate the grinding of these seating surfaces, use is made of the interlocking cutter such as shown in Fig. 4a. This cutter is made in three sections, *A*, *B*, and *C*. *A* has compound relief to the left, *B* has radial relief, and *C* has compound relief to the right. The form is carried across the dividing lines on the lugs of the interlocks. When changed by grinding, the three sections may be adjusted together or apart and the interlocking lugs will mill the form without leaving a burr.

Straight surfaces and curved female contours present no difficulty to interlocking, but curved male contours do not permit of adjustable interlock. In Fig. 5, it is obvious that compound relief in the direction of the arrows will give a decreasing width of form *E* and *F* when grinding. When *E* and *F* are again brought to the correct width, the contour at *S* will be incorrect because the curve on the interlocking lugs cannot be correct when they are pulled apart. Also since the compound relief runs off the center of the cutter, the true width will never be correct after grinding. However, curved male contours cause no trouble for non-adjustable interlocks as in 4b.

Then Fig. 4a shows a Type *B* cutter, interlocking and adjustable while 4b shows a Type *C* cutter, interlocking but non-adjustable with all sections of necessity having radial relief. Fig. 6 shows a Type *D* cutter, interlocking, overlapping, and adjustable. Here *A* and *B* are circular form cutters while *F* and *G* are standard milling cutters with possibly a slight alteration to suit dimension *f*. Another method would be to select *G* and make the diameter of *B* to suit dimension *f*. Of course, this dimension will have to be maintained when grinding the gang of cutters. When designing interlocks have the lugs so arranged that when the cutter is assembled the gashes will not come in line. This will distribute the strain of cutting.

Form cutters range all the way from a simple solid tool for milling a radius to an intricate built up tool designed to form a complex shape. But if the designer will keep before him the principles outlined, he can attack his problem with assurance of success. Modifications of the four tool types described will meet any service requirements.

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Cheaper in the End—*Discussion*

CHARLES E. GALLES

THE EDITORIAL which appeared on page 492, Vol. 73, under this head, took me back to 1915 when I came to New York City. I had learned my trade under old school mechanics in the Middle West and had advanced to the rank of foreman.

I found the shops in this vicinity in need of good mechanics but usually unwilling to pay the price of a skilled man. After several unsatisfactory starts, I answered an advertisement for a toolmaker. On applying for the job, I was told that all they ever paid was 55 cents an hour. When I turned to leave, I was stopped by the owner who said he liked my independence and was willing to give me a chance. The first job was similar to one which had been done before, and I managed to save 60 per cent on the previous cost. After two months, I was asked to take charge of the toolroom and accepted only on condition that I be given responsibility both for hiring and firing men for my department and for the rate paid them. I have since followed the policy of paying adequate wages for good mechanics and have found this course to be the most economical.

NEW BOOKS

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ELECTRO-DEPOSITION OF METALS (NINTH CORRECTED EDITION)—*By Dr. George Langbein and William T. Brannt. 875 pages, 6¼x9¼ in. Indexed and Appendixed. 185 illustrations. Published by Henry Carey Baird & Company, 2 West 45th Street, New York, N. Y. Price $7.50.*

The ninth edition of this standard work contains the former vast amount of plating and metal polishing information, including tested formulas for solutions, apparatus and instruments, and useful tables for the plater and polisher. This new edition pays particular attention to the newer types of equipment, including plating machines, ball-bearing grinding and polishing apparatus, sandblast cleaning units, lacquer spraying, and electric ovens for drying and baking.

The section on the nomenclature of plating materials is unusually complete and lists all known names for the various substances. A historical review, for those interested in sources and growth, is also incorporated, as is a theoretical section describing fundamental principles. The principal portion of the volume, however, remains the discussion of practical plating, a discussion as complete as any in the English language. Plating with platinum and palladium is described, but that with iridium and rhodium is only mentioned. The major portion of the plating information, as would be expected, deals with copper, nickel, silver, gold, cobalt, brass, and bronze, tin, zinc, lead, and iron deposition. The co-deposition of metals, probably the latest development in this field, is however, not mentioned.

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CHEMISTRY OF ENGINEERING MATERIALS (THIRD EDITION)—*By Robert B. Leighou, M.S., Professor of Chemistry, Carnegie Institute of Technology. 684 pages, 5½x8 in. Indexed. 100 illustrations. Clothboard covers. Published by the McGraw-Hill Book Company 370 Seventh Ave., New York, N. Y. Price $4.50.*

Development within the past few years of hydrogenation, high-compression engines and anti-knock gasolines, high-strength alloys, the Aston process, new materials for tools bits, apparent solution of the baffling problem of the passivity of metals, and dozens of other important changes in the chemistry of materials have occurred within the past several years. These have necessitated complete revision and enlargement by 150 pages of this standard text. It is primarily a college text for instruction in the chemistry of materials, therefore presupposes an elementary course in general chemistry, but differs from most earlier texts in that it attacks the problem from the standpoint of the user, not that of the producer. Methods of manufacture are neither emphasized nor presented in detail.

Typical chapters include: Water for Steam Generation, Fuels, Refractory Materials, The Non-Ferrous Metals, Non-Ferrous Alloys, Iron and Steel, Corrosion of Iron and Steel, Foundry Sands, Building Stones, Lime and Gypsum Products, Cements, Clay Products, Paints, Varnishes, Stains, and Fillers, Lubricants, Glue, Rubber, Electrical Insulating Materials, Electric Cells, and Hydrometry. Because of its planning as a student's text the practical man may find material included which he deems unnecessary, or elementary, but it is an unusually well-handled discussion of this subject from the chemical angle.

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POISE—*By Frank Godley. 22 pages, 4¾ x 7 in. Paper covers. Published by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Single copies $0.25; over 100, $0.18; over 250, $0.15; over 1,000, special quotations.*

Some months ago, a salesman of many years' standing put down on paper his creed of selling. He called it "Poise." His sales manager read the few pages, believed, and had "the greatest single thing in making sales" copied to be sent to all the organization's far-flung salesmen. And soon the requests began coming in—salesmen had shown their copies of the creed to friends. And still the requests keep coming in. To meet the demand from business and sales executives, this little pocket-size pamphlet has been prepared, telling in simple words Frank Godley's creed. And until you've read "Poise," there's much to learn about selling, even though you have but your daily work to merchandise.

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TREATISE ON LEATHER BELTING—*By George B. Haven and George W. Swett, Professors of Machine Design, Massachusetts Institute of Technology. 249 pages, 5½x7¾ in. Indexed and thumb indexed. 77 illustrations and 25 tables. Clothboard covers. Published by the American Leather Belting Association, 41 Park Row, New York City. Price $1.50.*

After seventy-two years of power transmission by means of leather belting, the industry has at last seen fit to assemble its data into publishable form, and has produced this handbook. A list of chapters perhaps best indicates the character of the volume. Chapters are: Leather Manufacture, Physical Properties of Belting Leather, Methods of Manufacture of Leather Belting, Belting Practice, Installation and Care of Leather Belting, Leather Belts on Motor Installations, Belt Drive Engineering, Belt Research, Specifications and Inspection, Tables, Nomographs, and Charts.

Though published by the American Leather Belting Association and distributed through its member dealers, the volume is a distinct engineering contribution containing no advertising. Results of the tests and experience of the individual manufacturer have been coupled with university research in its preparation. It answers among others, the old question of whether belts should be run flesh side or grain side to the pulley, the first the European method, the second the American. To answer it here would be presuming.

The Foreman's Round Table

DIRECT ACTION

"HEY, Ed, come here, quick," hailed Al, as the two friends loitered in the main office building on their way to foremen's meeting. "Here's a new notice, Ed, and I'll bet you'll agree with it."

"I'm kinda getting hardened to notices now. It seems to me, though, if I wanted publicity so bad, I'd have my photograph on each notice."

"Maybe he's saving that till he can't think of anything else, like an advertising man does. You can always tell, that way, when their ideas have played out. But Williams is different, Ed. Listen: 'To All Department Heads: Effective this date, Mr. G. B. Williams will assume the title of General Superintendent, reporting directly to me. Signed, Keith Madden, President and General Manager.' Ain't that great, Ed? Williams sure deserves it."

"Yeah, but why couldn't the old man boost him without slapping somebody else on the wrist?"

"What do you mean by that?"

"Why that 'report directly' stuff. The treasurer and the secretary are both vice-presidents. That notice puts Williams on a par with them."

"Well, why not? As a matter of fact it don't, but I am glad to see the old man recognizes that a mechanical executive is as valuable as an accountant or a paymaster."

"Have it your way. But where does that 'general' stuff come in? One superintendent can't be general, can he? That's the reason why shops have personnel managers, restaurant managers and athletic managers. So the old man can be a general manager."

"Check, Ed. When we open up the Colbyville plant that we closed last fall, and enlarge the foundry, we'll hire a couple of superintendents for the same reason. I think the old man is fixing it so that Williams can run the whole thing, without interference."

"Yeah, maybe. But what do the two vices think of that?"

"I suppose they don't like it. But what difference does that make? The shop makes the money, and that fact should be recognized. As it is, the vice-presidents claim all the credit for the good showings, and blame the shop for the bad ones. They can't do that now, for probably Williams will also be present at board meetings."

"Well, I should worry. I guess I'll be Mr. Edward Graham, 'general' foreman, reporting direct to general superintendent who reports direct to the general manager, who—"

Should Williams be placed on an equality with the heads of other divisions?

Is the importance of costs and other clerical functions overemphasized?

▸ ▸ ▸ Discussion of Former Topics

The Stork's Assistant

Physicians of the highest rank invariably are too occupied with their private practice to permit rendering service as shop doctors. For this reason most firms that retain a physician are compelled to engage the services of a younger doctor or one whose private practice is less extensive.

The question arises, therefore, if the average shop doctor is qualified to diagnose obscure physical derangements. Originally shop doctors were intended to give aid in case of accidents and to administer relief to anyone stricken ill while at work. And this unquestionably should remain the limit of their function.

However, should a firm inaugurate a policy of physical examination as a means of determining a man's fitness for employment, a certificate from his own physician should suffice. This applies also for the periodic examinations during his term of employment.

The tendency, when manufacturing firms adopt a system of physical examinations as a basis for determining a man's fitness for employment, is not merely to select men having physical characteristics necessary for the work in view, but rather to eliminate applicants having physical defects or organic ailments that, while not such as would affect their capacity for work, yet represent a certain business risk.

The group insurance policies covering employees that most manufacturers take out are based on the law of averages, so no physical examination of the individual employee is required. As the employer is thus protected it would be an injustice to discharge an employee or deny employment to a man simply because he has some organic weakness when such weakness does not render him ill to any extent nor affect his ability to handle the work. —JOHN A. LAWSON, *Heald Machine Company.*

Whistlin' Willie

To all intents, and for practical purposes, we can say that the average worker becomes inured to ordinary noises. It is the unusual noise that distracts attention and causes unaccounted-for lost time on shop jobs. The nervous, fidgety type of workman, generally an excellent mechanic and a big producer, seldom gets used to discordant noises. The problem then is to segregate this type as far from general noise as possible.

Noise can be lessened to a certain extent by continuously and everlastingly keeping after the boisterous workers. Whether or not anything is gained by an anti-noise crusade is open to debate. I have found it better to let the noisy individual enjoy himself and take his enthusiasm out in work.

We had a strong-voiced singer, Bill Quoits, who could make more noise than the cast gears of the rubber mill he was running. Later we put him in the machine shop and Bill's singing and enthusiasm stepped up the rest of the shop boys a notch or two. When we began to curb promiscuous scrapping of parts and equipment from the various departments in the mill, Bill, due to his noisy orations was designated supervisor of scrapping. He passed on all pieces or equipment about to be scrapped, saving anything useful. Many a friendly but noisy bit of advice to offending parties was handed out by Bill. Due to his noisy, attention-drawing attitude, his value to us was inestimable.

—E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan, Inc.*

Bad Debts

It is not a function of management to act as a collecting agency, nor have we ever heard of any firm doing so. Without proper court authority such a proceeding would be illegal.

This is another story, in the case of garnishees. A garnishee is backed by a court judgment and according to law a fixed percentage must be deducted from the debtor's salary or wage. The only way around this is to discharge the offending employee.

We do not believe any such notice as Williams sent out would have a tendency to encourage the thriftless to go into debt with the intention of dodging payment. There is always a remedy to the creditor through the judgment and garnishee route with costs and interest assessed against the debtor.

—E. F. WEIMAR, *Asst. Cost Accountant, De Laval Separator Company.*

The Exception to the Rule

The practice of cutting piece work prices is not justified, ethical, or good policy if the only excuse for such action is the fact that certain highly skilled operators are earning amounts exceeding the management's idea of what constitutes a maximum wage. The history of industrial and scientific management is replete with examples of the failure of wage incentive plans, particularly piece work, resulting from the formula:

(1) Poor management seizes upon piece work as a panacea for its ills and, ignoring all the governing principles in its quest of profit, proceeds to: (2) guess or otherwise set rates carelessly and inaccurately, (3) does not guarantee rates. (4) Inaccurate high rates bring unexpected high wages to some, (5) these high rates are cut, (6) repetition of 4 and 5 if rates still allow excessive earnings. (7) Finally, soldiering on the part of employees in an effort not to exceed what they have discovered to be the maximum allowable wage, (8) complete breakdown of morale of the organization usually resulting in strikes and later in the return to day work and rejection of incentive plan as a failure.

The setting of accurate rates is a much more difficult task than many people realize. It requires the highest

type of intelligence and good judgment based on experience. The qualifications of a good rate setter and the procedures for him to follow have been so widely advertised in the literature of management that there is little excuse for tolerating the poor grade of rate setting that is common in many plants.

Rates should be set to allow the average good operator to make the bonus he is intended to make as an incentive to meet production standards. If you are fortunate enough to have some highly skilled men who "run away" with the job, rejoice in private, and while in the shop study their methods and learn that all the brains are not in the front office. The knowledge so gained should be passed on to the other operators on the same job, if possible. They will appreciate it and the added production with its resultant saving in overhead will amply repay the management for the slight effort involved. —W. B. LINCOLN, JR., *Chief Engineer, W. J. Savage Company.*

Wide Open

The roll top desk in the foreman's office is no fault of his; he has to be content with the cast-off furniture from the front office. But it is his fault if he does not make a flat top desk out of it and requisition for a filing cabinet.

When he gets these things, why not give him a glass enclosed office to keep them in so that he can keep his records and other equipment necessary to a foreman reasonably clean.

The foreman who can send in a neat, clean, daily report will take more pride in the things that are contained in it than the foreman who has to make his reports out at a desk in the open shop where it is impossible to keep them clean.

The location is not so important as long as it is placed where it can be properly ventilated, as he should spend at least two-thirds of his time in the open shop. If he has men working for him that have to be watched then he should be allowed to replace them.

The old time taskmaster who had his desk on a raised platform in the middle of the shop where he was the target for someone's chunk of babbitt has passed.

—L. G. PATTERSON, *Factory Superintendent, Armstrong Machine Works.*

The Stork's Assistant

Compulsory medical examinations would be a good thing if the doctor employed is a good one and if they are conducted in a fair manner.

As most physicians are honest and men of high standing in the communities where they live, it would be all right to accept certificates from them.

Employees would have to pay for the examination, however, if they went to any other than the work's physician.

In most cases once a year would be enough, but it should vary with the occupation, as men who are doing heavy hauling and lifting, or working in polishing and plating rooms, etc., are more liable to strains, injuries, and occupational diseases than a man working in an office, or tool room. —THOMAS M. GARRY, *Yale & Towne Mfg. Company.*

Age and Its Compensations

For the good of the community, it would appear that the wage paid should be based on the needs of the man rather than upon his skill, age or seniority. A man with a wife and five children to keep should, for the good of the community, be paid more than a single man with no responsibilities.

As, however, with our present system of business the good of the firm seems to be the object of all schemes of wage payment, benefits given to the man simply being incentives for him to increase his output, the wage should be paid upon the value of the man's services, past, present, and future.

The value of a man's services depends on all the items listed, and for the following reasons:

Age: An older man is generally more prone to remain with a firm, hence any money expended in giving the man experience or training is more likely to be repaid than it is when expended in training a younger man.

Experience: If a man has spent a great part of his life accumulating a store of information by moving from works to works, this should be recognized, for it will be of great value to the firm.

Knowledge: If a man has spent time and money in acquiring knowledge which will be of use to the firm it should be recognized by increased pay.

Seniority: If a man has been with the firm for a long time it generally means that he is reliable and dependable, hence this should be the reason for an increase in pay.

Exactly in what proportion the values of the above points should be fixed will be difficult to ascertain and will depend upon the nature of the business and upon the type of man. —HARRY SHAW, *Lancashire, England.*

No Exceptions

When a blanket no-raise order is issued it should apply to everyone. There should be no exceptions. No man in the organization should be given a special privilege.

When times are bad and the company is doing everything possible to reduce costs, so as to keep the plant going and as many men as possible employed, it would be unfair to give one man a raise.

It might be pointed out that the man in question would make up the raise himself by doing more and better work. But would he? The chances are that being ambitious he has been doing his best anyhow.

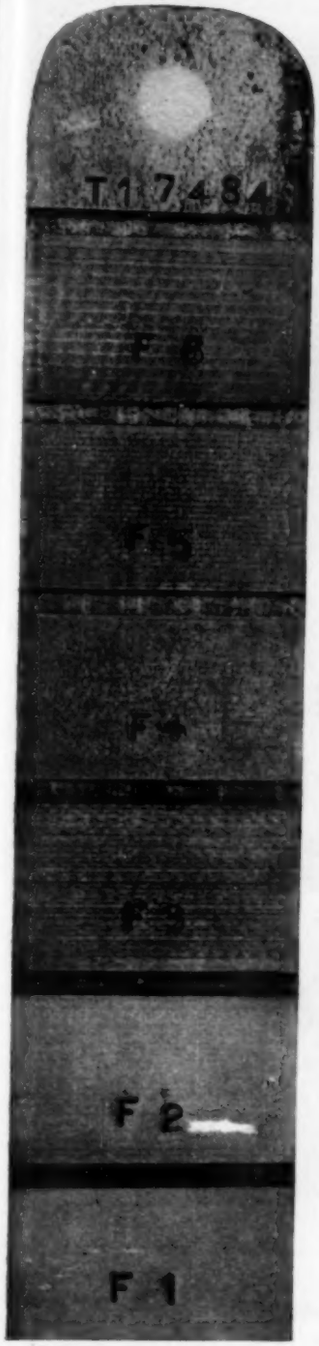
There is also another question to consider, that of getting a new job lined up in order to "work" a raise out of the boss. It is an old stunt and the foreman should not fall for it.

If the foreman feels that the man is deserving of a raise, and will make a valuable man for the company in the future, he should be promised an increase as soon as business warrants. If he still insists on quitting, then the only thing to do is to let him go. His actions show that he has no interest in the company that he has been working for.

The boy's side of the question, of course, must not be overlooked. He is probably finding the going hard, as are also his fellow workmen in these bad times. He should therefore take the position paying the most money, and the foreman should be glad to see him better himself.

—CHARLES O. LEWIS, *Lucas Machine Tool Company.*

Standards for Surface Finishes



These sample bars of six typical finishes are carefully prepared and serve as references for both machinists and draftsmen

SURFACE FINISHES	
F 6	Rough machine finish, used for machining clearances, where appearance or close fit are not important or where surfaces are to be filled and painted.
F 5	Medium machine finish as used on most machined surfaces.
F 4	Fine machine or tool finish, mainly used where special accuracy or appearance is required or where surface is to be scraped.
F 3	This might be termed 'rough machine-ground' surface, though it could also be produced in shop work by filing or other means, used mainly for hardened surfaces which only need truing up.
F 2	Regular smooth finish, used for most ground work unless special smoothness is required.
F 1	Dead-smooth finish - to be used where special appearance or accuracy is required, as for gaging surfaces, surfaces to be lapped, bearings for high speed spindles etc.

Accompanying the bar is a photostat chart describing in detail the six types of finishes

S. M. RANSOME

Chief Draftsman, Barber-Colman Company

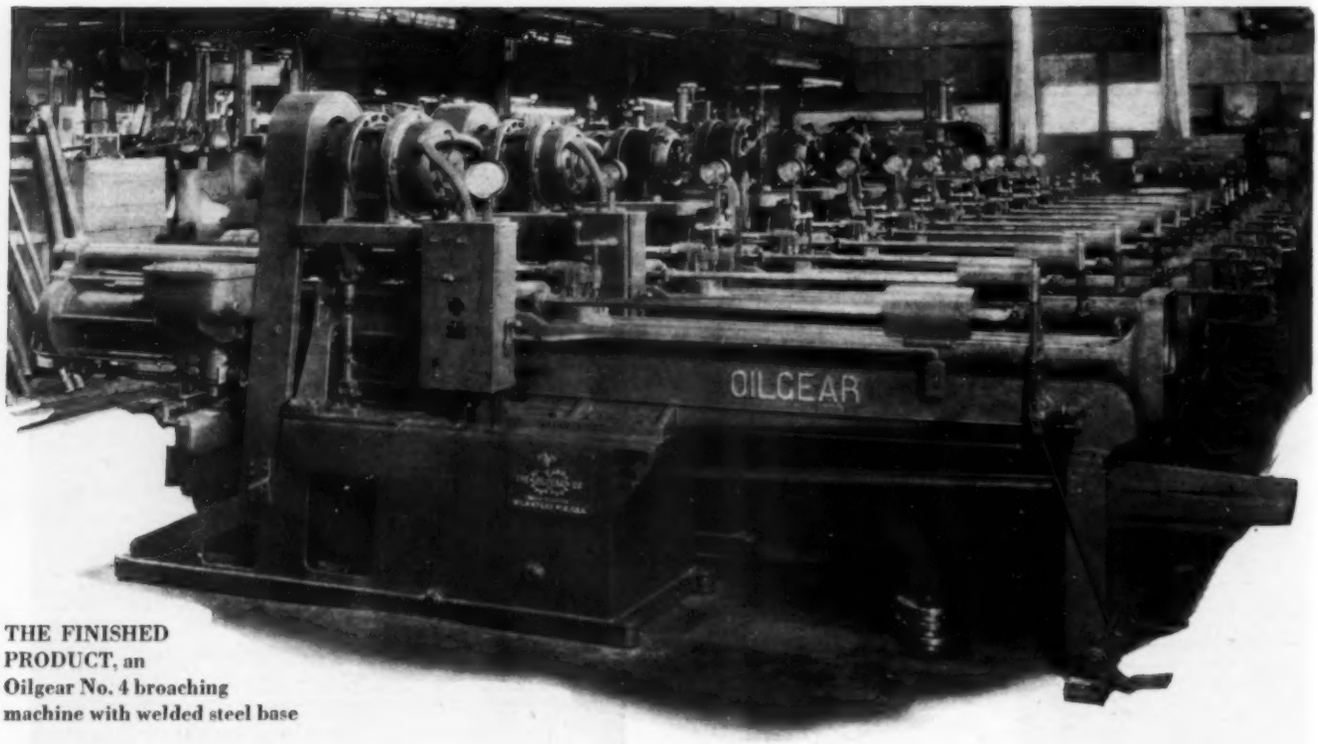
QUALITY of finish required on machined, ground, or scraped metal surfaces has been a problem for many years. Not only do the different methods of machining affect the finish surfaces, but the material itself plays an important part. Particularly where piece work or premium methods are in use, is it natural for the operator to claim that the finish on a piece of work is sufficiently good for the purpose it serves, whereas the inspector may have an entirely different opinion. Without any standard to go by, it is rather difficult to settle such questions.

In order to overcome these difficulties the Barber-Colman Company determined to see what could be done to remedy, if not entirely cure, this trouble. But what method to use in determining the smoothness of a given surface? A surface may be wavy, pitted, torn, scratched, show too deep feed marks, or vary from absolute smoothness in other ways. Tool marks on some pieces are straight, and in others curved. Some surfaces may be flat, others circular, either internal or external, or can be even helical in form, as on screw threads. The material itself must also be considered. For example, what would be a good finish on cast iron of open texture would be a very poor finish on a piece of steel; a good finish on steel might not be satisfactory on Monel metal or Stainless Steel.

It was felt that it would be almost impossible to hold the shop to absolute scientific accuracy of surface finish. But a much closer standard than the generally used finish marks on blueprints could be set up. This was done by preparing a set of sample bars on which six types of finish are shown, F-1 being what we term a dead smooth surface, F-2 slightly rougher, and so on up to F-6, which is a rough machine finish. Supplementing this sample bar is a table or chart describing the types of finish in detail. These charts and sample bars are distributed at strategic points throughout the shop and in the drafting room, so that the new finish symbols on the print give a man all the information he needs.

This method is simple to install and does not seem to cause any difficulty in operation. While it may be considered comparative and empirical rather than scientific, it has proved practical and economical, avoiding as it does the use of elaborate instruments of any kind. It need not be limited to six surface conditions, but can be increased to any number desired.

It was no simple matter to obtain a photograph of this bar that would show clearly the differences in the surface finish. Because the relations of light, surface, and the retina of the human eye are not the same as the combination of light, lens, and photographic plate, it was necessary to make several attempts before obtaining a representative photograph.

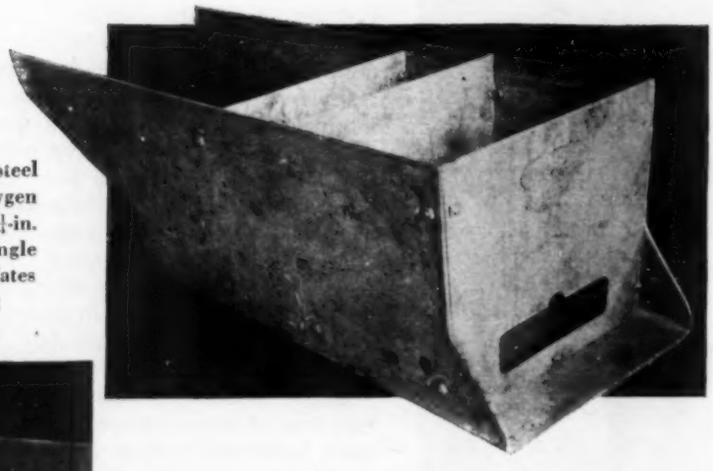


THE FINISHED PRODUCT, an Oilgear No. 4 broaching machine with welded steel base

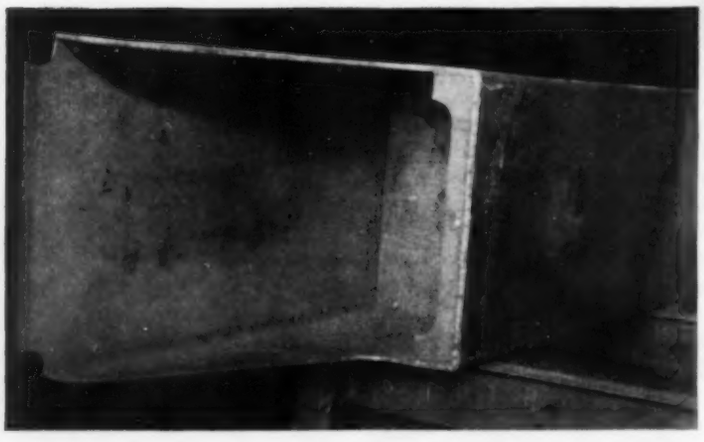
WELDED MACHINE BASES

Need Not Be Unsightly

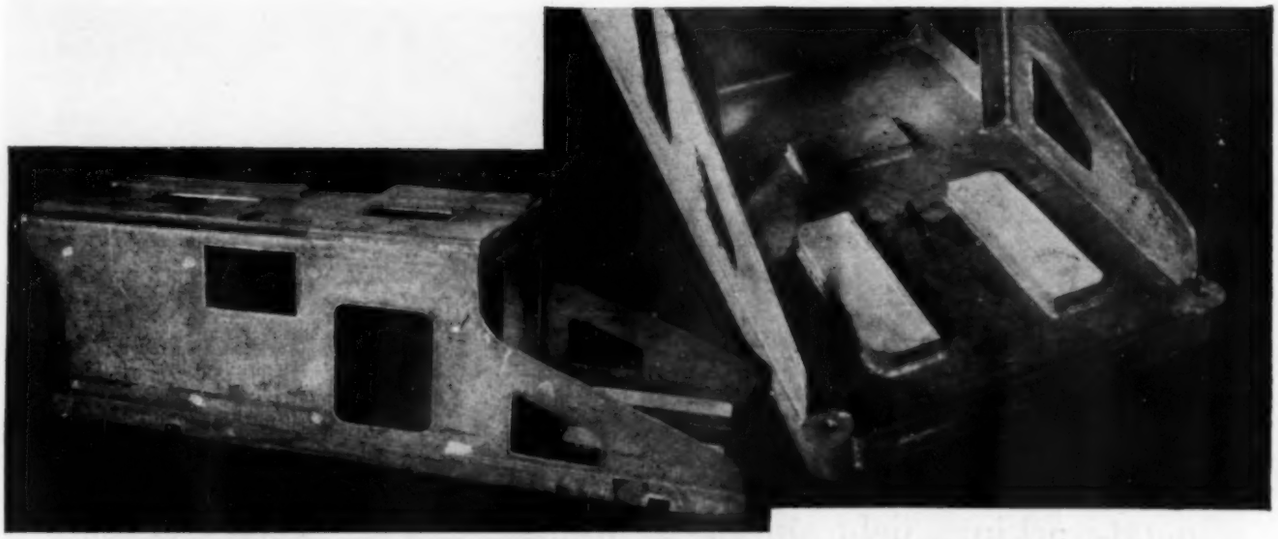
Photographs by courtesy of the Lakeside Bridge and Steel Company, Milwaukee, Wis.



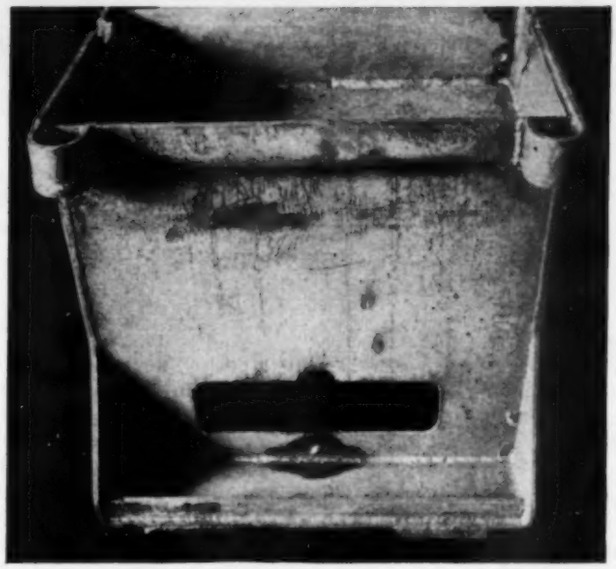
RIGHT—Preliminary stage—A ¾-in. steel plate, hand cut to shape by the oxygen torch, is bent into U-shape with a 1¼-in. radius at the corners. Temporary angle clips and stove bolts hold the cross plates in position prior to tack welding



LEFT — While the assembly is placed on its side on steel "horses," the base plate is welded in position. Bites have been taken in the corners by the torch preparatory to welding in round end pieces



LEFT ABOVE — The completed base in the semi-rough state. Holes in the sides have been burned out, the pads welded in position, and clamp bolt holes filled. For additional strength and improved appearance, a 2-in. flat strip is welded along the bottom. External beads are chipped smooth and ground; internal fillets are buffed smooth with a pneumatic hand grinder



ABOVE — Another treatment of corners

ABOVE—Treatment of corners. The bar stock has been previously drilled and is positioned for welding by a pin jig

ALL welding is done electrically with a heat-treated rod. Since a section of the base forms a reservoir for oil, the welds are tested for tightness and density by filling the compartments with kerosene. Forged drainage plugs, purchased tapped, are welded at the collars into holes cut in the side plates by the torch.

Sequence of Operations

Layout plate and oxy-cut contours
Punch clamp bolt holes
Bend two corners
Bolt up
Tack weld
Continuous weld, electrically
Cut out holes in sides and top

ABOVE—A group of completed bases, turned upside down. To the right can be seen a reinforcing strip located under the motor pads to reduce deflection of the large flat base plate when the pads are being machined in place

CO-OPERATION as an INCENTIVE

The B. & O. Union-Management co-operation plan is first extended to the general metal-working field in a pump manufacturing plant

CHARLES YEOMANS
President, Yeomans Brothers Company

■

BECAUSE its chief claim was the right to organize and deal with management as a unit, generally with the idea of bettering labor's economic condition, the trade union has had to strong arm its way into industry. It had nothing to offer management in return. In recent years, however, more enlightened labor leaders have been seeking to develop an arrangement that would be mutually satisfactory. Following the apparently successful operation of a union-management co-operation plan installed in the shops of the B. & O. in 1922, labor officials sought to apply this scheme to other railroads. The Canadian National Railways adopted such a plan in 1925, and to a limited degree other roads are using it successfully today.

The first attempt to apply the B. & O. plan to a commercial metal-working shop was made in our plant last summer. Yeomans Brothers Company is a comparatively small concern engaged in the manufacture of pumping machinery. The character of our work is such that little standardization or quantity production is possible, so that the installation of bonus or piece work schemes could not be considered seriously as a means to increase efficiency. Moreover, we had been operating for many years as a closed union shop, and the machinists' union would not accept any such plans. Since our relations with this group had always been satisfactory, our labor turnover practically nil, and our men highly skilled in this kind of work, we put it up to the union to suggest what they could offer to offset the differential between the regular union scale and the average open shop wage.

In the course of the discussions we had with labor officials, attention was directed to the B. & O. plan, which appeared to give promise, since conditions in our factory, on a small scale, were quite similar to those in a typical railroad shop. At our request, therefore, a memorandum of such a plan was submitted by the union, and with slight modifications was approved by both management and men. It was immediately put into operation. In essence, the men as members of their union, accept a definite responsibility for the welfare and progress of the company which they undertake to promote by contributing in every possible way toward increased shop efficiency, by reducing waste, improving quality of work, as well as assisting in sales promotion. The company agrees to delegate this responsibility, continues to recognize the union, and without any specific obligation, agrees from time to time to share with its employees in the gains resulting from co-operation. What the men stand to gain are greater security of employment, the satisfaction of having a voice in the management of the company, and some share in the benefits of co-operation as the business prospers. Management gains increased morale, increased efficiency, and a lower cost of production.

These ends are accomplished by the men themselves making suggestions as to how to increase efficiency, even to the extent of suggesting the replacement of obsolete machinery with modern equipment, despite the fact that men may thereby be thrown out of work. This *is* enlightened labor policy. What the men actually get is a voice in the management of the shop, although the plan does not affect the executive management of the company nor shift responsibility or final control of its affairs. The plan tends to keep the foremen on the job since the men can point out very explicitly just where management, through its "non-coms" is failing to do its part. In fact, this is actually what took place in the first few meetings.

It might appear that such a procedure would demoralize shop discipline, but such has not been the case. While the men feel that they can reach the "higher-ups" directly, they recognize the fact that orders will continue to come through their foremen.

The plan functions through a joint committee consisting, on the labor side, of the shop committee chairman, two shop men selected by the men, and the local union representative, and on the management side, of the general manager, chief engineer, superintendent, purchasing agent, foreman and assistant. The general manager serves as chairman. Meetings are held monthly during working hours, and are most informal in character, decisions being reached by consensus rather than by a formal vote.

Among the subjects dealt with by the committee are: increased output, production costs, equipment, spoilage and breakage, departmental co-operation, overhead, safety and sanitation, stabilization of employment, division of work in slack periods, sales promotion and distribution,

business conditions and the outlook. Questions of wage scale, hours, and working conditions are handled between the management and the union officials, as before. Incidentally, before the plan was installed, the shop was completely modernized, not in view of this plan, but in connection with a broad study of shop efficiency.

All suggestions are kept on the minutes as unfinished business until either rejected or adopted. No prizes are given for ideas, nor is the proponent identified in the records, but the suggestion is coded as coming from an employee or from management. Meeting in a spirit of friendliness and mutual confidence, the committee serves as a conveyance and crystallizing agent for verbal suggestions which any employee may submit through any member of the committee. Every idea, however impractical it may appear, is given fair and courteous consideration. Proposals involving purchase of new equipment or other capital or operating expense are referred to the proper department for estimate of investment and savings to be expected, and action is taken on the basis of reports presented.

While a few months' experience is hardly sufficient to insure the permanence of such a scheme, the results obtained to date and the enthusiastic support received lead us to believe that we have taken a step in the right direction. We do not regard this experiment as an adventure in altruism, but rather as a matter of enlightened self-interest, based on the assumption that the fortunes of the company and its employees are synonymous and interdependent, and that they can be advanced best by common counsel.

Teaching Engineering—*Discussion*

JOHN YOUNGER
Professor of Industrial Engineering,
The Ohio State University

I AM INTERESTED in the editorial, Vol. 73, page 898, on the prestige of the teaching profession. I am one of these fortunates (I use the word after due thought) who resigned from industry after 25 years of practice to enter the professorial profession. I find my new work exceedingly likeable. I have opportunities to do the things I long wished to do, but for which I had not the time. I would not go back to industry again for all its emoluments.

I find myself with sufficient leisure to enjoy the good things of life and yet with enough work to keep me stimulated. The contacts with the young men seeking out a realization of their ambitions is especially inspiring and must be experienced to be understood.

Finally, I feel that we of the professoriate in engineering are doing a worth-while function of engineering. We are furnishing the raw material which will eventually be fabricated into the executives of our plants. Time will justify our pioneer work in the training of personnel.

Men count more than equipment, however, wonderful it may be, and time will bring an appreciation from those we have trained which will undoubtedly redound to an enhancement of our prestige.

It is only a matter of time, but the signs are visible that the educator in engineering will soon be raised to his true position in industrial affairs.

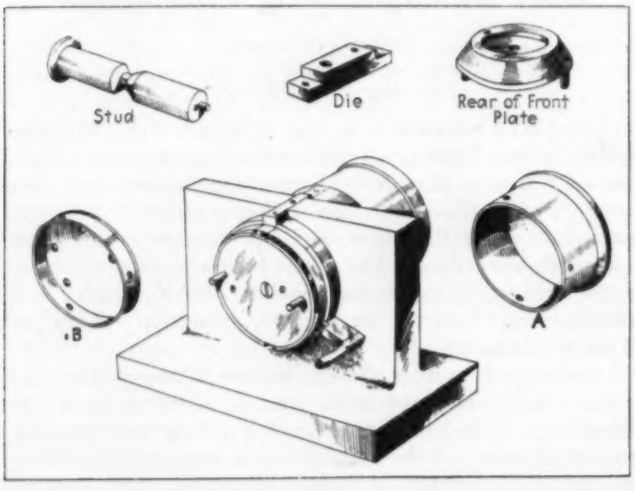
IDEAS FROM PRACTICAL MEN

Tool for Punching Radial Hole

CHARLES H. WILLEY
Superintendent of Manufacturing,
Hoyt Electrical Instrument Works

SOMETIMES in the ever-present competition for a share of the business in our field, we are called upon to devise quickly tools for some change in the product. To meet such an emergency, the tool here described was turned out in two days by a toolmaker, with the assistance of an apprentice to do the turning and the plain milling for him.

The instrument case *A* and its base *B* were to have three equidistant holes punched in them radially. The work was done on the combination tool shown in the illustration, thus eliminating at least a part of the cost of two tools. Since quantity production was not contemplated, we made the tool as quickly and as cheaply as possible. The tool has a T-shaped base having a vertical web in the center, to the top of which the die is fastened in a slot. At the front and back of the vertical web are pilot rings for locating the work centrally, the rings being slotted to fit over the sides of the die. Inside of the front pilot ring is a plate fitted to revolve on the end of a stud that is firmly secured in a



hole in the vertical web. This plate is counterbored at the back to fit the end of the stud, to which it is pivoted by a screw.

Two pins in the plate serve to locate the work by engaging holes previously punched in the bottom. In the end of the stud is a spring pin engaging a hole in the plate. The pin is rounded on the end, so that it will move inward in the stud when the plate is revolved, thus disengaging it from its mating hole. The object of this pin is to so locate the work that the first hole punched will be in a definite position in regard to the holes in the bottom. The back of the plate is beveled to allow the punchings to pass around it and escape through a slot in the bottom of the pilot ring. The work is placed over the pilot ring and the front end of the die. It is located on the pins in the plate, and its location for the first hole to be punched is by the engagement of the spring pin in the hole in the plate.

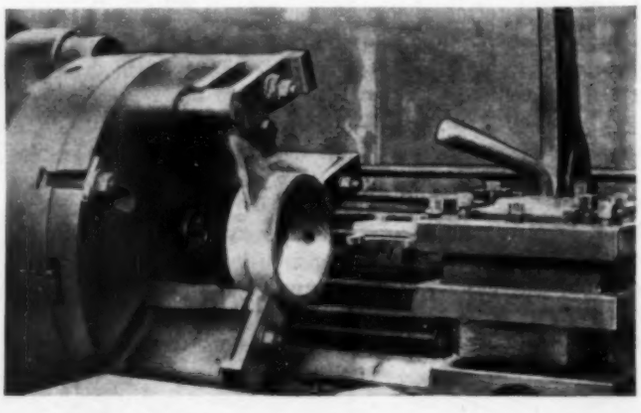
In this position, the first hole is punched. The work is then rotated by hand upon the pilot ring, and a sliding index pin, located 120 deg. from the center of the hole in the die, engages the hole just punched. The work is now in position for punching the second hole. Repeating the operation brings the work in position for punching the third, and last, hole.

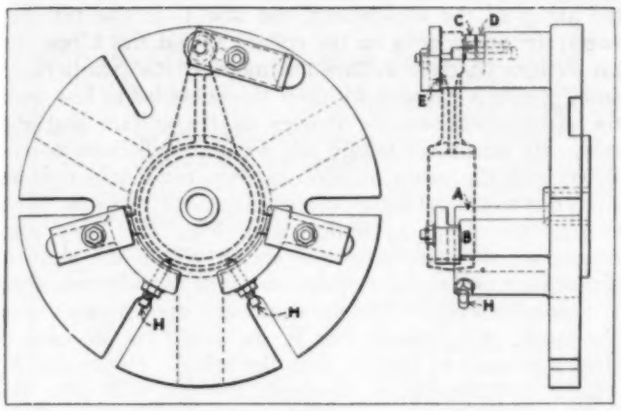
The case is placed over a sleeve fitted to revolve on the rear end of the stud and against the rear pilot ring. Since the holes to be punched in the case do not have to be located radially in relation to other holes, the first hole can be punched in any location. The work and the sleeve are rotated by hand, and the indexing is done in the same way as in the case of the base, a similar index pin being attached to the rear of the vertical web. The body of the stud, directly under the hole in the die, has a wide groove to allow the punchings to pass around it and out of a slot in the bottom of the pilot ring.

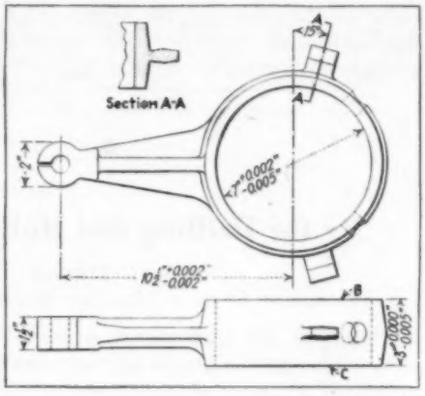
Fixture for Boring and Facing Eccentric Straps

CHARLES C. TOMNEY
Chief Tool Designer, Brunswick-Kroeschell Company

The illustration is of a special fixture for boring and facing eccentric straps, one of which is shown in Fig. 2. The straps each have two lugs located 15 deg. on each side of the center line, which together with the heads of the straps form a three-point bearing in the fixture. After the machining has been completed the lugs are broken off. Being thin where they join the bodies of the straps, they are easily removed, leaving but slight fins that are readily dressed off with a file. The clamping surfaces of the lugs are angular in two directions, so that the high points will bear on the locating points of







the fixture and on the clamps, thus eliminating the danger of springing the straps in clamping.

The body of the fixture is mounted on the lathe chuck by bolts through slots corresponding to those in the chuck, the chuck jaws having been removed. Since the seats for the jaws project about ¼ in. from the face of the chuck, pockets are cast in the back of the fixture to prevent interference. The fixture is centered by a short pilot that enters the central hole in the chuck.

The straps are held in the fixture by clamping the lugs against the projections *A* and *B* and the heads against the rounded button *C*. The button is removable so that straps having thicker heads can be held in the same fixture, in which case the heads are clamped against the button *D*. The clamp for the heads is reversed, so that its heel rests upon the surface *E* the large holes in the straps are rough and finish bored by cutter heads on bars that are piloted in a bushing in the base of the fixture. After boring, the surfaces *B* and *C*, Fig. 1, are faced simultaneously by two cutters in a bar that is held in the square turret on the cross-slide, as shown at *A* in the set-up in Fig. 2. Since the straps are cast from metal patterns, they are so nearly alike that the centering screws *H*, Fig. 1, seldom have to be changed after the initial adjustment.

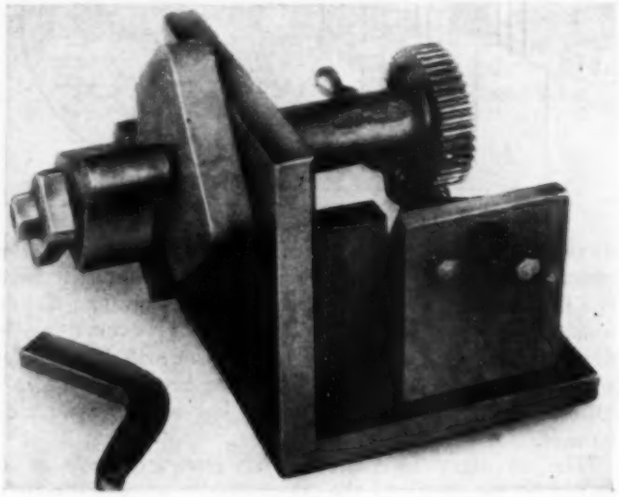
■

Machining the Ram Ends of Press Rockers

AVERY E. GRANVILLE

A fixture for machining the rounded ends of press rockers where they seat in the rams is shown in the illustration. The work is done in a shaper by a gooseneck tool, cuts being taken lengthwise of the bearing as the rocker is rotated. The rocker *A* is attached to the faceplate by a strap clamp, being located at the crankpin end by a stud fitting the crankpin hole, which has been previously bored. The end to be machined is located by a pin fitting in a small hole previously drilled in the center of the bearing. In addition to locating the end to be machined, the pin serves to prevent it from shifting during machining.

Rotation for the feed is accomplished by a gear on



the shaft to which the faceplate is attached. A worm, meshing with the gear, is turned by a ball crank on the end of the worm shaft. The shaft to which the faceplate is attached, and the pin locating the end of the rocker to be machined are, of course, concentric.

■

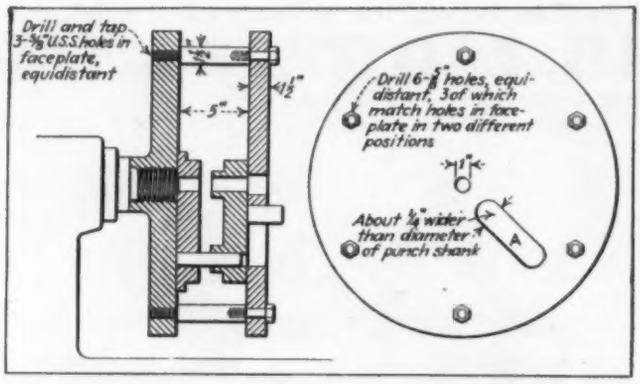
Boring Die-Sets for Leader Pins

CHARLES A. ARCHBOLD
Salt Lake Stamp Company

The method described for boring the holes for leader pins in pillar-press tools has been in use in our shop for a number of years. The lathe in which the work is done is equipped with an auxiliary faceplate, mounted on the regular faceplate by three shoulder studs, and separated from it about 5 in., as shown in the illustration. A hardened bushing is inserted in the spindle to support and guide the boring bar. A drill, a rose reamer and the clamps for holding the work, complete the equipment.

In operation, the punch-holder is clamped to the inner surface of the auxiliary faceplate, and the die-shoe to the outer surface of the regular faceplate, both parts being in correct alignment. A drill somewhat smaller than the leader pins is used to drill the holes. After one of the holes has been drilled through both parts, it is carefully bored and reamed. The parts are then removed from the lathe and a leader pin is ground to fit the hole and is inserted in both parts. With the leader pin in place, the parts are returned to the lathe, being clamped as before, and the second hole is drilled, bored and reamed. Then the second leader pin is ground to fit and is inserted.

In order that the work may be done correctly, both faceplates must run true and the spindle must be parallel with the center line of the ways in both directions. The studs separating the two faceplates must be accurately of the same length between the shoulders. While


Drill and tap 3-⅜" U.S.S. holes in faceplate, equidistant
4½"
5"
Drill 6-⅜" holes, equidistant, 3 of which match holes in faceplate in two different positions
1"
About ¼" wider than diameter of punch shank
A

there are various methods of doing this job, for the ordinary shop having limited equipment, I doubt if there is a method that will produce a more accurate or a better finished job than the one described. If everything is done correctly, the parts of the die-set will be parallel with each other when the pins have been inserted. A little oil on the pilot of the boring bar will save a lot of trouble.

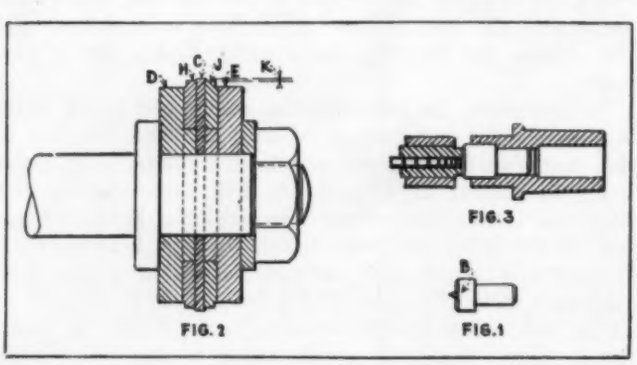
The auxiliary faceplate has an elongated hole at *A* to permit the shank of the punch-holder to pass through. If the die-sets are large, it will be necessary to attach a counterweight to one of the faceplates to prevent excessive vibration. While there are but three studs used to separate the two faceplates, we drill and ream six holes, equidistantly spaced, in the auxiliary faceplate, so that it can be shifted to different positions.

■

Using a Screw-Slotting Attachment for Burring

HAROLD P. BERRY

When cutting off work, such as the part shown in Fig. 1, there will always be a burr, or teat, left by the work parting from the bar before the cut-off tool has reached the center. If the burred end is slightly slotted by the regular screw-slotting attachment, as at *B*, the



burr will be removed. However, the slot should be as shallow as is possible, and should not extend to the outer diameter of the piece. Ordinarily, the depth of the slot will vary 0.010 in. or more, according to the accuracy of the mechanism of the slotting attachment.

The depth of the slot can be controlled within very close limits by the arrangement shown in Fig. 2. On the arbor of the attachment, the saw *C* is clamped between the projections on the collars *D* and *E*. Upon the projections of these collars are mounted the washers *H* and *J*, being a running fit, their thickness being less than the spaces between the flanges of the collars and the saw. By this construction the washers will cease to revolve with the arbor as soon as they come into contact with the work, acting as stops to prevent the saw from cutting too deep, as indicated in Fig. 3. They also counteract the tension of the spring within the slotting attachment and of the mechanism of the transferring arm.

Since the washers become stationary upon contact with the work, they cannot mar it, as would be the case if they continued to revolve with the arbor. Dimension *K*, Fig. 2, will determine the depth the saw will enter the work. It can be so controlled by the difference in diameters of the saw and the washers as to insure that the flat surface of the work will not be injured and require another operation to restore it.

■

Jig for Drilling and Hollow Milling

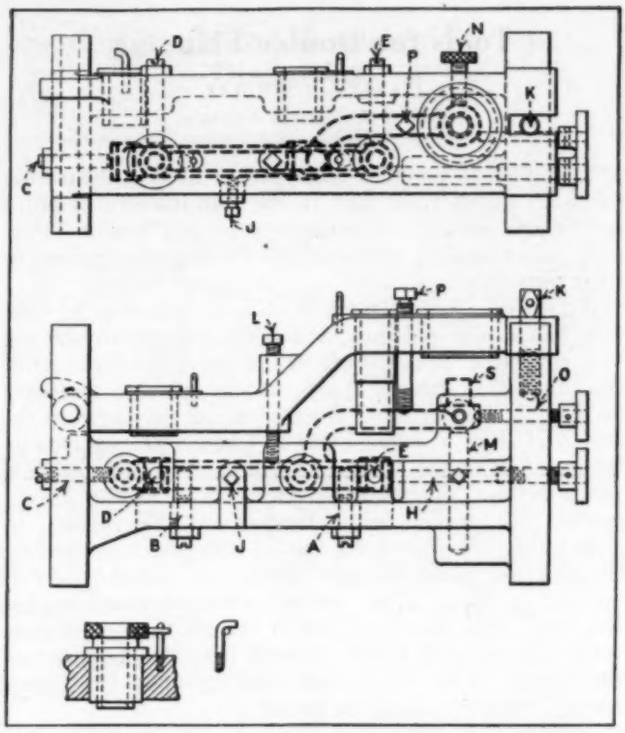
F. H. MAYOH
Designing Engineer, Package Machinery Company

Owing to the frail nature of certain parts, it is advisable when practical to do all the machining at one setting, requiring a rather complicated jig, such as the one illustrated.

The work shown in the jig, in heavy dotted lines, has four bosses to be drilled and spot faced, and one projection to be hollow milled. The jig has a cast-iron base and a hinged cover, all the locating points for the work being in the base. When the work is placed in the jig, it rests upon the screws *A* and *B*, and is located against the stop screw *C*. At the same end, it is pushed over against the stop screw *D*, while at the opposite end it is pushed against the stop screw *E*. At the right, the long screw *H*, tightened by a hand knob, contacts with the round boss of the work, slightly out of the center, pushing it against the stop screw *C* and over against the screws *D* and *E*. As an additional precaution, the setscrew *J* is tightened against the work to hold it securely against the thrust of drilling from the opposite side.

After the hinged cover has been swung into position, it is locked by a quarter turn of the screw *K*, following which the setscrew *L* is tightened against the work. The pin *M*, backed by a spring, is released and is allowed to rise and contact with the work. It is then locked by a setscrew, forming a rigid support. The knurled screw *N* is then adjusted until it just contacts with the work, following which screw *O* is tightened by means of its hand knob. Thus the end carrying the projection to be hollow milled is rigidly held against the turning thrust, and in addition, the setscrew *P* holds the work securely against the pin *M*, which has been previously locked in position.

Four guide bushings are used in combination with a series of slip bushings, each of which is prevented from turning by a pin in the flange engaging a hook in the bushing plate, as shown in the partly sectional view in the lower left-hand corner. After drilling the four holes, the slip bushings are removed and the bosses are spot faced by tools fitting the guide bushings. In hollow



milling the projection *S*, two mills are used, one for roughing and the other for finishing.

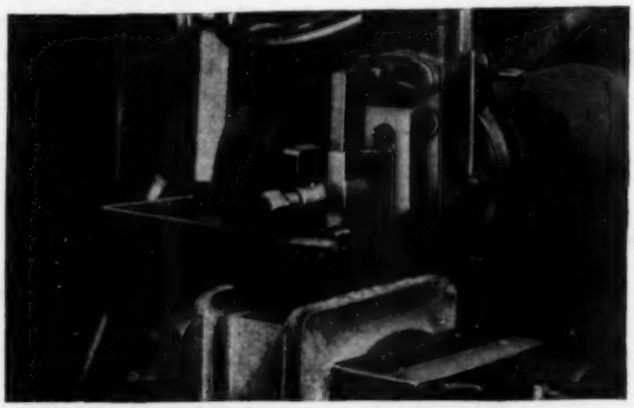
While all the operations are comparatively simple ones, an attempt to perform each one in a separate jig would make correct alignment a difficult matter. The types of clamping screws have been chosen with the object of indicating to the operator the amount of force to be used in operating them. Screws fitted with hand knobs are intended to hold the work tightly against the stop screws. Where the head of the screw is knurled, the intention is to just bring it in contact with the work. Screws having heads to fit wrenches are to be tightened securely.

■

Combined Chip Guard and Brush

MATTHEW HARRIS

When material is machined at high speed, chips—especially those of brass—will fly for a considerable distance, much to the annoyance and danger to the eyes of nearby workers. In such cases, chip guards are desirable, if not an absolute necessity. While many types of chip guards are in use, the one illustrated presents some novel features. It is in use at the Sayre, Pa., shops of the Lehigh Valley Railroad.



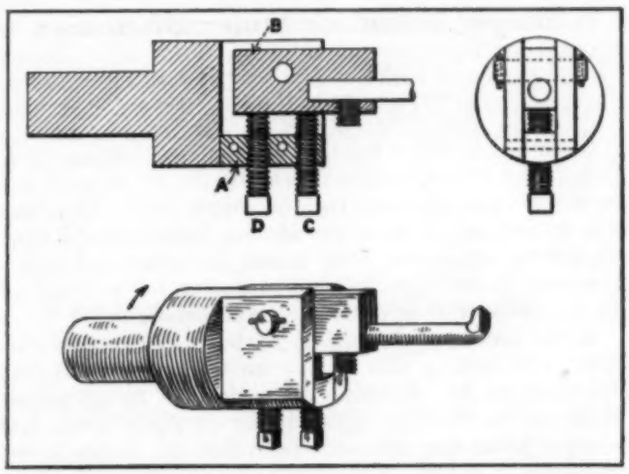
The brush is flexibly attached, in front of the tool, to the clapper of a shaper by two strips of spring steel, thus permitting it to pass over obstructions. In addition to acting as an efficient chip guard, it also serves to brush the chips off of the work on the back stroke of the shaper ram.

■

An Expansion Boring Head

RALPH E. HENDRICKSON
Machinist, Alexander Anderson, Mining and Petroleum Engineer

An expansion boring head that is simple in design and construction is shown in the illustration. The body of the tool is nickel steel and has a $\frac{3}{8}$-in. slot milled through it to a depth of $1\frac{1}{4}$ in. The segment *A* is



inserted in the slot and fastened by pins. The toolholder *B* is $\frac{3}{8}$ x $\frac{3}{4}$-in. cold-drawn steel. After drilling and reaming the hole for the pivot pin, drilling the hole for the tool, and drilling and tapping the hole for the setscrew, the toolholder is casehardened and fitted snugly into the milled slot.

As can readily be seen, backing out screw *C* and tightening screw *D* will result in swinging the tool holder about the pivot pin and bringing the point of the tool farther from the center line. The opposite manipulation of these screws will, of course, bring the point of the tool nearer the center line.

■

Removing a Jammed Setscrew
Discussion

B. HALLMAN

In his discussion of the article under the title given above, on page 256, Vol. 74, of the *American Machinist*, J. T. Towlson goes on to tell how he removed the

hammer head of a heavy steam hammer from the piston rod. It appears to me that the method described by Mr. Towlson was a somewhat expensive and laborious one, especially when one considers the simple and very effective means for producing the expansion through the use of the oxyacetylene blowpipe.

If the use of a half-ton of molten metal imparted enough heat to expand the head, it would appear that devices in common use, such as a preheating torch or even a good charcoal fire properly located, might have served as an expedient. The method outlined by Mr. Towlson is similar to the old method of repairing defective castings by burning in with molten metal, which has been superseded by the more modern practice of welding by means of the torch or the arc. The use of the torch or the arc, or the charcoal fire would have been preferable, by virtue of their economy, to the handling of such a mass of molten metal, preparing a suitable container, and then reclaiming the metal for melting.

■

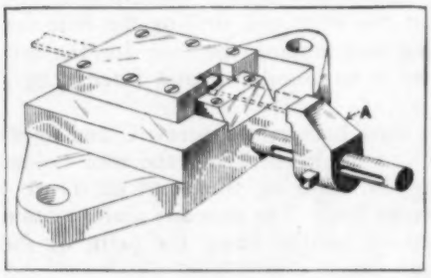
A Simple Automatic Stop—*Discussion*

CHARLES H. WILLEY

Superintendent of Manufacturing,
Hoyt Electrical Instrument Works

In an article under the title given above, on page 216, Vol. 74, of the *American Machinist*, R. H. Kasper describes a very ingenious type of simple stop. Thinking that the stop might be of use at some future time, I have clipped the article for filing among my notes and kinks. However, I feel sure that the particular job referred to by Mr. Kasper does not need an automatic stop.

In the accompanying sketch is shown the type of die, fitted with a stop, that we use on work similar to that described by Mr. Kasper. In operation, the advancing stock strikes the stop *A*, while the combined guide and stripper holds and strips the main part of the stock, the piece that is cut off dropping freely over the end of the die-block and toward the undercut part of the stop.



The strip can then be fed for the next cut.

The trouble with Mr. Kasper's die is that the hole is too far from the end of the die-shoe, and that the combined guide and stripper extends too far toward the cutting-off side of the die. If the ends of the pieces cut off were of the shape shown by Mr. Kasper, there would be no danger of their sticking to the punch, and so would not require to be stripped.

Tools for Double Flanging

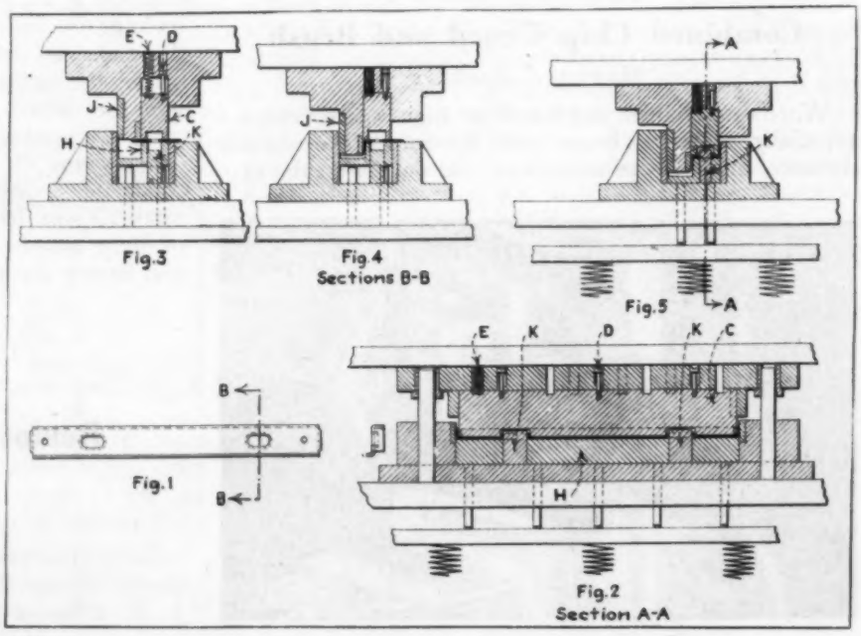
HARRY G. SCHOLTZ

Tool & Die Room Foreman,
Heavy Stamping Division, The Murray Corporation

The type of flanging tools shown in the illustration has been successfully used in the manufacture of automobile chassis and the stampings for the bodies. Possibly other readers will find still further applications in their own shops.

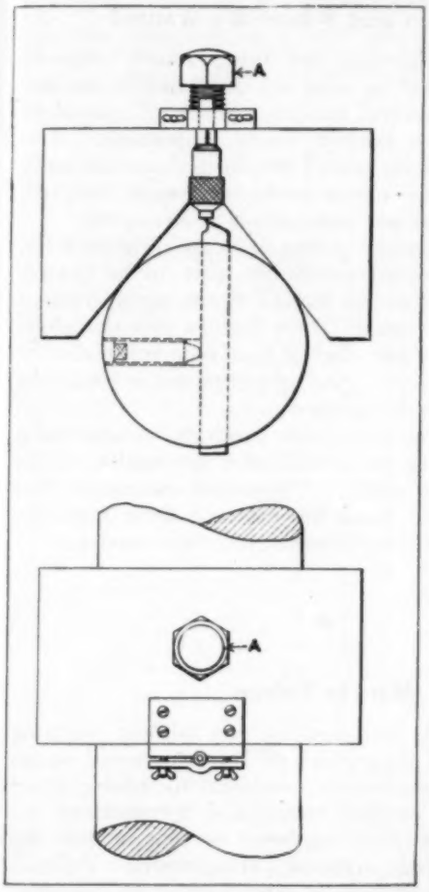
A finished piece of work is illustrated in Fig. 1. One side flange, the end flanges and the flanges around the two elongated holes extend in the same direction, while the other side flange extends in the opposite direction. In Fig. 2 is a sectional front view of the tools on the line *A-A*, Fig. 5, while Figs. 3, 4 and 5 are sections on the line *B-B* of the work. As will be noted, the punch *C* has a certain amount of vertical travel in the punch-holder, the travel being limited by the screws *D*. Springs *E* are placed on top of the punch, extending through the punch-holder. When the punch-holder is secured in place, these springs are compressed against the ram. The knockout pad *H* travels in the die-shoe, riding on pins that extend through both the die-shoe and the bolster, their lower ends bearing upon the heavy, spring pressure-pad of the press.

In operation, as the ram descends, the punch *C* strikes the work, and its further downward movement being arrested, it acts as a pressure pad. Continued downward movement of the ram causes the punch *J* to form the first flange, as in Fig. 4. Inasmuch as the springs in the pressure-pad of the press are a great deal heavier and stronger than those in the punch-holder, the knockout pad *H* remains stationary until the upper end of punch *C* contacts with the punch-holder. Then the knockout pad begins to descend, the work descending with it. At this time the second side flange and the end flanges are formed by the punch *C*. As the knockout pad nears the bottom of the die-shoe, the necking punches *K* begin to form the flanges around the elongated holes, completing the work when it strikes the bottom of the die-shoe. Figs. 2 and 5 show this part of the operation.



Setting Tools for Precision Boring
Discussion

R. G. HEWITT
Keighly, England



I was much interested in the article by Ernest Foldvary, under the title given above, on page 26, Vol. 74, of the *American Machinist*, as it recalled to mind my method of setting boring-bar cutters.

Referring to the illustration, the stem of an internal micrometer is attached to the V-block by a suitable bracket held thereon by thumb screws. The knurled-head screw *A* fits in a tapped hole and is provided with a locknut. In operation, the V-block is placed on top of the boring bar and a gage block of the same thickness that the cutter is to project from the bar for boring the hole to the finished diameter is placed next to the cutter. The micrometer spindle and the knurled-head screw are both brought into contact with the gage block, and the knurled-head screw is locked by its nut. The gage block is then removed and the micrometer spindle is lowered an amount equal to the difference between the roughing and the finishing cuts.

The V-block is slid along the top of the bar until the micrometer spindle is directly over the cutter. All that remains to be done is to adjust the cutter to bring it into contact with the micrometer spindle. For the finishing cut, the cutter is brought into contact with the knurled-head screw, which was previously set to the gage block.

■

Two-Position Work Marker

HARRY MOORE

Recently I had a large quantity of short, square rods of various lengths, each of which was required to have a hole drilled approximately through the middle, both in length and in width. Since the rods varied in thickness as well as in length, it looked as though locating for the drill was going to be a lengthy job. However, I hit

upon an idea that made it possible to mark the rods in two movements.

Two pieces of hardwood, 1-in. square, were attached to the bench, as shown in the illustration. Midway between them a broken hacksaw blade was driven in the bench, teeth upward. The distance between the hardwood strips was such that the rods had to be placed diagonally between them. With a rod chalked approximately in the middle, it was placed diagonally between the hardwood strips, chalked side down, and touching the saw blade. Moving the rod back and forth a couple of times, parallel with the strips, the saw blade made a diagonal line on the chalked spot. The rod was then turned end for end, horizontally, and the process was repeated. The result was two diagonal marks crossing each other, the intersection of the marks being approximately in the center of the length and the width of the rod. One of the rods so marked can be seen in the lower part of the illustration.

■

Cutting Multiple Screw Threads
Discussion

FRANCIS W. SHAW
Consulting Engineer, Heywood, England

In an article under the title given above, on page 23, Vol. 74, of the *American Machinist*, John Pearman criticizes a method of indexing for multiple-thread screws described by Harvey Chandler on page 172, Vol. 73. According to Mr. Chandler's method, the slide of the compound rest, after the first thread has been cut, is fed longitudinally a distance equal to the pitch, and a second thread space is then cut, the process being repeated for the third and fourth spaces.

As Mr. Pearman explains, very few compound rests have sufficient movement to negotiate screws of long lead, such as $6\frac{3}{4}$ in., if the criticized method be followed. It is possible to index for multiple threads by the same principle, but rather differently applied. And here is the way: Supposing, for example, a four-thread screw having a lead of $6\frac{3}{4}$ in. is to be cut in a lathe having a lead screw of $\frac{1}{2}$ in. lead.

Cut one thread space. Disengage the lead-screw nut. Traverse the carriage along the ways in either direction for $1\frac{1}{2}$ in. Re-engage the nut, which can fall into position, because $1\frac{1}{2}$ in. is an integral number of lead screw pitches. Adjust the compound-rest slide longitudinally through $\frac{3}{16}$ in., making the total movement of the tool $1\frac{1}{2} + \frac{3}{16}$ in. $= 1\frac{11}{16}$ in., or one pitch length of the screw to be cut. Cut the second thread space and repeat the operation for the third and fourth spaces.

Now, since the total movement of the compound-rest

slide has been but three times $\frac{3}{16}$ in. in cutting all the thread spaces, the maximum error that can occur, neglecting errors in the lead screw, is that in a $\frac{3}{16}$-in. length of the compound-rest screw, and not that in a length of three work pitches, as in the former method. For the same reason this method would be preferable even for screws having a short lead. Errors of excess, but not of shortage, can be compensated for by inclining the compound rest to the work axis.

In the same example, the carriage might have been traversed four lead-screw pitches and the compound-rest slide adjusted in the opposite direction to reduce the 2-in. travel of the tool to $1\frac{11}{16}$ in. Ordinarily the number of lead-screw pitches should be such as to necessitate the smallest adjustment of the compound-rest slide, providing the adjustment is by the screw and is not determined by gage blocks. The compound-rest screw is seldom an object of precision and is subject to rapid wear. A word of warning: Multi-thread screws should never be produced by completely finishing a thread space at a time. All the spaces should be roughed out to release inherent stresses caused by the method of working the material.

■

Driving Work by Three Dogs
Discussion

DONALD RAEBURN
Glasgow, Scotland

In discussing an article by Harry Moore, under the title given above, on page 1,000, Vol. 72, of the *American Machinist*, J. T. Towlson suggests (page 789, Vol. 73) that the use of three dogs does not remove the whole of the torsion caused by the pressure of the cut, because of the relatively small mandrel. With this I agree. But the same objection can be used against his own alternative method. In neither case is the work correctly driven. The fundamental principle of lathe work is that the work should revolve upon its own axis and that the drive should be balanced.

In Mr. Towlson's method he bores and taps a suitable hole in the end of the work, inserts a capscrew backed by a thick washer, and uses a small angle plate as a driver. This method is incorrect. A second tapped hole diametrically opposite to the first one, fitted with a capscrew and a washer, and another angle-plate driver on the faceplate, are necessary before the work can be considered correctly driven. The second fault is that Mr. Towlson's drive is too near the center of the work, thus lacking the power required for a heavy cut. It is also likely to throw the work out of truth.

In Mr. Moore's method, his work is driven from the greatest distance from the center that his dogs will permit. If an angle-plate driver had been fastened on the opposite side of the faceplate in contact with the tail-catch, then Mr. Towlson's objection in regard to the torsion caused by the pressure of the cut would be removed:

In conclusion, permit me to congratulate Mr. Moore on his very clever use of three dogs. His method is worthy of the wide publicity given it in the pages of *American Machinist*.

SEEN AND HEARD

•

Heat—When and Where It's Wanted

SCORES of applications are being found today in which electric heating units are displacing steam and other sources, for several reasons. Accurate control of temperature between narrow limits is possible. Fire hazards often are decreased. The heat is almost instantly available. No fumes or air contamination is involved. And the heat can be put right where it is wanted.

Many standard electric heating units are now available. Some can be embedded within the part to be heated. Others can be immersed in liquid. Some supply radiant heat at high temperatures. These factors, plus the added convenience, often make electric heat economical despite fairly high power costs. And where power is cheap the gain is correspondingly greater.

There is room for many new products incorporating such units as well as for much wider application of the units to existing products. Uncounted companies that have discovered and made the most of these facts are finding an ever widening market for their products.

—*N.*

•

Mars to Vulcan

ASTRONOMERS just couldn't rest without knowing whether or not the atmosphere of Mars contained water. That required super-sensitive emulsions for photographic plates. Eastman evolved them, and astronomers cut plate exposure time from ten hours to four in their determinations. Then someone remembered Vulcan's needs. The result is a super-panchromatic film combining speed, color-sensitiveness, and fine grain for photomicrographic work. Also, it permits industrial pictures with one-third to one-fifth the amount of artificial light formerly necessary.

—*T.*

•

Sample Stampings Cheap

A COMPANY in Chicago has developed a technique for turning out samples of stamped blanks quickly and cheaply. A hundred or more stampings can be produced within 10 to 48 hours at the cost of two to three hand-made samples. Since the process is not patentable, no precise information regarding it has been divulged.

Any size blank up to 34x36 in. that could ordinarily be handled in a press up to 100-ton capacity is the present limit. Steel up to $\frac{3}{8}$-in. thick, non-ferrous metals, fiber, or celluloid are possible materials. Aside from blanking, simple forming or bending operations can be performed. If necessary, the limits on important dimensions can be held within ± 0.001 in. There is no limit on the amount of complication of the design. Besides being directly applicable to making sample pieces prior to tooling up permanently, the process may also be used for actual production where small runs are involved and where special tooling would be prohibitive in cost.—*S.*

Forming Properties of Thin Sheets of Some Non-Ferrous Metals

Abstracted from an A.I.M.E. paper by W. A. Straw, M. D. Helfrick, and C. R. Fischrupp. Chemical compositions given are averages; bending characteristics of materials with slightly different proportions of minor elements will be approximately the same

High-brass Sheet (Cu 66, Pb 0.3, Fe 0.05, Imp 0.1, Rem Zn)

Temper, B. & S. Numbers Hard	Thickness B. & S. Gage	Thickness Inches	Rockwell Hardness (1/16-in. Ball × 100-kg. Load × Red Figures)	Minimum Suitable Radius of Punch: Bend Perpendicular to Direction of Rolling	Bend 45° to Direction of Rolling	Bend Parallel to Direction of Rolling
½ Hard 2	20	0.0319	67	Sharp	Sharp	Sharp
	18	0.0403	66	Sharp	Sharp	Sharp
	15	0.0571	68	Sharp	Sharp	Sharp
	14	0.0641	70	Sharp	Sharp	Sharp
	11	0.0907	73	Sharp	Sharp	Sharp
⅝ Hard 3	24	0.0201	67	Sharp	Sharp	Sharp
	20	0.0319	71	Sharp	Sharp	Sharp
	16	0.0508	78	Sharp	Sharp	0.0156"
	14	0.0641	78	0.0156"	0.0156"	0.0312"
	11	0.0907	77	0.0156"	0.0312"	0.0937"
Hard 4	30	0.0100		Sharp	Sharp	Sharp
	24	0.0201	76	Sharp	Sharp	Sharp
	22	0.0253	79	Sharp	Sharp	Sharp
	20	0.0319	80	Sharp	Sharp	0.0156"
	18	0.0403	82	Sharp	Sharp	0.0312"
	17	0.0451	83	Sharp	0.0156"	0.0625"
	16	0.0508	84	Sharp	0.0156"	0.0937"
	15	0.0571	83	0.0156"	0.0312"	0.0937"
	14	0.0641	82	0.0312"	0.0312"	0.0937"
	12	0.0808	82	0.0312"	0.0625"	0.0937"
	11	0.0907	84	0.0937"	0.1250"	*
	10	0.1019	81	*	*	*
	9	0.1144	84	*	*	*
		0.1250	80	*	*	*
Extra Hard 6	24	0.0201	83	0.0156"	0.0312"	0.0937"
	20	0.0319	85	0.0312"	0.0625"	*
	19	0.0359	87	0.0625"	0.0937"	*
	18	0.0403	87	0.0625"	0.1250"	*
	17	0.0451	88	0.0625"	0.1250"	*
	16	0.0508	88	0.0625"	0.1250"	*
	15	0.0571	88	0.0937"	*	*
	14	0.0641	89	0.1250"	*	*
	13	0.0719	89	0.1250"	*	*
	11	0.0907	87	*	*	*
Spring 8	30	0.0100		Sharp	0.0156"	0.0937"
	26	0.0159		0.0156"	0.0625"	*
	24	0.0201	88	0.0312"	0.0937"	*
	22	0.0253	90	0.0312"	*	*
	20	0.0319	88	0.0312"	*	*
	18	0.0403	92	0.0625"	*	*
	16	0.0508	90	0.0937"	*	*
	14	0.0641	92	0.1250"	*	*

Brass Sheet (Cu 65.5, Pb 0.95, Fe 0.08, Rem Zn Imp 0.1)

Temper, B. & S. Numbers Hard	Thickness B. & S. Gage	Thickness Inches	Rockwell Hardness (1/16-in. Ball × 100-kg. Load × Red Figures)	Minimum Suitable Radius of Punch: Bend Perpendicular to Direction of Rolling	Bend 45° to Direction of Rolling	Bend Parallel to Direction of Rolling
½ Hard 1	14	0.0641	59	Sharp	Sharp	Sharp
½ Hard 2	18	0.0403	63	Sharp	Sharp	Sharp
	16	0.0508	71	Sharp	0.0156"	0.0312"
	14	0.0641	65	Sharp	0.0156"	0.0312"
	12	0.0808	71	0.0625"	0.0625"	0.0937"

Phosphor-bronze Sheet (Cu 92, Pb 0.02, Fe 0.10, Zn 0.20, Sn 8, P 0.15, Sb 0.01)

Temper, B. & S. Numbers Hard	Thickness B. & S. Gage	Thickness Inches	Rockwell Hardness (1/16-in. Ball × 100-kg. Load × Red Figures)	Minimum Suitable Radius of Punch: Bend Perpendicular to Direction of Rolling	Bend 45° to Direction of Rolling	Bend Parallel to Direction of Rolling
½ Hard 2	25	0.0179		Sharp	Sharp	Sharp
	19	0.0359	61	Sharp	Sharp	Sharp
	14	0.0641	56	Sharp	Sharp	Sharp
	13	0.0719	62	Sharp	Sharp	0.0625"
Hard 4	28	0.0159		Sharp	0.0156"	0.0156"
	20	0.0319	76	0.0625"	0.1250"	*
	16	0.0508	75	0.0937"	0.1250"	*
	14	0.0641	75	0.1250"	0.1250"	*
	10	0.1019	75	*	*	*
Spring 8	24	0.0201	79	0.0312"	0.1250" *	*
	20	0.0319	82	0.0937"	*	*
	18	0.0403	82	0.0937"	*	*
	16	0.0508	82	0.0937"	*	*
Extra Spring 10	26	0.0159		0.0156"	0.0937"	*
	24	0.0201	80	0.0312"	0.1250"	*
	22	0.0253	83	0.0625"	*	*
	20	0.0319	83	0.0937"	*	*

* None of the radii tested were suitable.

Clock-brass Sheet (Cu 62.5, Pb 1.6, Fe 0.06, Rem Zn Imp 0.1)

Temper, B. & S. Numbers Hard	Thickness B. & S. Gage	Thickness Inches	Rockwell Hardness (1/16-in. Ball × 100-kg. Load × Red Figures)	Minimum Suitable Radius of Punch: Bend Perpendicular to Direction of Rolling	Bend 45° to Direction of Rolling	Bend Parallel to Direction of Rolling
½ Hard 2	11	0.0907	71	0.0625"	0.0937"	0.0937"
Hard 4	24	0.0201	76	Sharp	0.0312"	0.0625"
	22	0.0253	81	0.0312"	0.0625"	0.0937"
	20	0.0319	80	0.0312"	0.0625"	0.0937"
	19	0.0359	83	0.0625"	0.0937"	*
	17	0.0451	80	0.0625"	0.0937"	*
	16	0.0508	84	0.0625"	0.0937"	*
	14	0.0641	82	0.0937"	0.1250"	*
	13	0.0719	83	0.1250"	*	*
	12	0.0808	82	0.1250"	*	*
	10	0.1019	79	*	*	*
	9	0.1144	81	*	*	*
		0.1250	79	*	*	*
Spring 8	24	0.0201	87	0.0625"	*	*

Nickel-silver Sheet (Cu 55, Pb 0.1, Fe 0.35, Zn 27, Ni 18, Mn 0.50)

Temper, B. & S. Numbers Hard	Thickness B. & S. Gage	Thickness Inches	Rockwell Hardness (1/16-in. Ball × 100-kg. Load × Red Figures)	Minimum Suitable Radius of Punch: Bend Perpendicular to Direction of Rolling	Bend 45° to Direction of Rolling	Bend Parallel to Direction of Rolling
½ Hard 2	24	0.0201	59	Sharp	Sharp	Sharp
	20	0.0319	62	Sharp	Sharp	Sharp
	18	0.0403	65	0.0625"	0.0625"	0.0625"
	16	0.0508	70	0.0625"	0.0625"	0.0625"
	15	0.0571	70	0.0625"	0.0625"	0.0937"
	14	0.0641	66	0.0625"	0.0625"	0.0937"
	9	0.1144	69	0.1250"	0.1250"	*
		0.1250	67	*	*	*
Hard 4	30	0.0100		Sharp	Sharp	0.0156"
	24	0.0201	71	0.0312"	0.0312"	0.0937"
	20	0.0319	70	0.0625"	0.0625"	0.0937"
	17	0.0452	73	0.0625"	0.0625"	0.0937"
	14	0.0641	73	0.0937"	0.0937"	*
	11	0.0907	74	*	*	*
Extra Hard 6	36	0.0050		Sharp	Sharp	Sharp
	30	0.0100		0.0156"	0.0156"	0.0156"
	28	0.0126	67	0.0156"	0.0156"	0.0156"
	27	0.0142	69	0.0156"	0.0156"	0.0312"
	26	0.0159	73	0.0312"	0.0625"	0.1250"
	25	0.0179	76	0.0312"	0.0625"	0.1250"
	22	0.0253	78	0.0937"	0.0937"	0.1250"
	20	0.0319	76	0.0937"	0.0937"	*
	19	0.0359	79	0.1250"	0.1250"	*
	18	0.0403	82	0.1250"	*	*
	16	0.0508	79	0.1250"	*	*
	14	0.0641	80	*	*	*

Phosphor-bronze Sheet (Cu 95.7, Pb 0.05, Fe 0.10, Zn 0.30, Sn 4.3, P 0.2, Sb 0.01)

Temper, B. & S. Numbers Hard	Thickness B. & S. Gage	Thickness Inches	Rockwell Hardness (1/16-in. Ball × 100-kg. Load × Red Figures)	Minimum Suitable Radius of Punch: Bend Perpendicular to Direction of Rolling	Bend 45° to Direction of Rolling	Bend Parallel to Direction of Rolling
½ Hard 2	24	0.0201	26	Sharp	Sharp	Sharp
	20	0.0319	38	Sharp	Sharp	Sharp
	14	0.0641	37	Sharp	Sharp	Sharp
	13	0.0719	42	Sharp	Sharp	Sharp
	12	0.0808	47	0.0625"	0.0625"	0.0625"
	11	0.0907	42	0.0625"	0.0625"	0.0625"
		0.1250	42	0.0937"	0.0937"	0.0937"
Hard 4	24	0.0201	59	Sharp	0.0312"	0.0625"
	20	0.0319	64	0.0156"	0.0625"	0.1250"
	18	0.0403	59	0.0625"	0.0625"	0.1250"
	16	0.0508	66	0.0625"	0.0937"	*
Extra Hard 6	17	0.0453	69	0.0625"	0.1250"	*
Spring 8	28	0.0126		Sharp	0.0625"	*
	27	0.0140		Sharp	0.0625"	*
	26	0.0159		0.0156"	0.0937"	*
	25	0.0179		0.0312"	0.1250"	*
	23	0.0226	72	0.0312"	0.1250"	*
	22	0.0253	72	0.0312"	0.1250"	*
	21	0.0285	67	0.0625"	*	*
	20	0.0319	71	0.0625"	*	*
	18	0.0403	74	0.0937"	*	*
	17	0.0452	75	0.0937"	*	*
	16	0.0508	75	0.0937"	*	*
	14	0.0641	74	0.1250"	*	*
	11	0.0907	73	*	*	*

* None of the radii tested were suitable.

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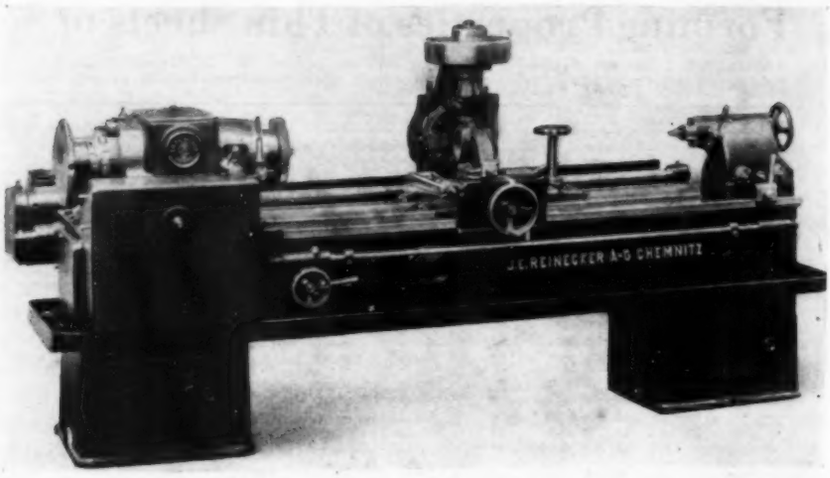
SHOP EQUIPMENT

NEWS



Reinecker Spline-Shaft and Pinion Hobbing Machine for shafts up to 80 in. long and gears to 8 in. in diameter

Reinecker Spline-Shaft and Pinion Hobbing Machine

Two models of the Reinecker spline-shaft and pinion hobbing machine are being introduced into the United States by the George Sherr Company, 142 Liberty St., New York, N. Y. These machines were exhibited at the Leipzig Fair. They are built by J. E. Reinecker, Chemnitz, Germany, and enable doing away with loose keys in machines and the resultant backlash. Any number of splines can be cut, and the hobbing process insures accurate spacing.

The two models are known as the No. 0 and the No. 1. Both are made to cut lengths of 20, 40, 60, and 80 in. The first is built for spline shafts and straight spur pinions, while the second is built for spline shafts, straight spur pinions, multiple-thread worms and multiple threads, and spiral gears and pinions. The largest diameter of gear taken in either case is 8 in., and the heaviest pitch in one cut in mild steel is 3½ DP.

The bed, which is ribbed on the inside, rests on two planed cabinet legs, and is surrounded by an oil base. Drive is by means of a single pulley and reversible countershaft. Where direct motor drive is specified, the reversible motor is attached to the base and connected with the single pulley. The cutter drive gearbox, the mechanism for rotating the work, and the feed for the carriage are located in the rear of the machine. On the left end of the bed are the pick-off gears and the change gears for the index and the cutter revolutions.

The massive work head has a hollow spindle with a 4-in. bore, the spindle running in adjustable taper bearings. The work is held by means of collets which are generally used in connection with cast-iron bushings. A center and faceplate are furnished for work which is preferably taken between centers. The spindle nose is threaded so that universal chucks may be attached.

Positive relationship between the rotation of the hob and the workpiece is afforded by means of change-gear connections between the cutter drive shaft and the work spindle. The dividing and feed gears are located in front of the bed. For hobbing spiral pinions and multiple threads on the No. 1 machine, a differential mechanism is provided. Feed, index, and lead change gears are independent, so that no difficult calculations of the ratio and change gears are required. When cutting helical gears, the right- and left-hand gears, even though they have different numbers of teeth, are cut with the same setting of the lead change gears. Thus, the helix angle of both gears is identical, resulting in a full bearing contact for the entire width of the face.

Rapid power traverse is provided for the cutterhead carriage in each direction. On helical and spiral gears, several cuts may be taken without losing the lead. The cutterhead is provided with graduations and a vernier, and is adjusted by means of worm and worm gear. The power required by the machine is 3 hp.

Detroit Lined Seamless Tubing

Steel tubing lined with various metals or alloys can be supplied by the Detroit Seamless Steel Tubes Company, Detroit, Mich. Such tubing can be lined in sizes from ½ in. o.d. up to 12 in. o.d., although at present sizes up to 2 in. o.d. are supplied for commercial purposes. Such tubes can be made in lengths up to 16 ft.

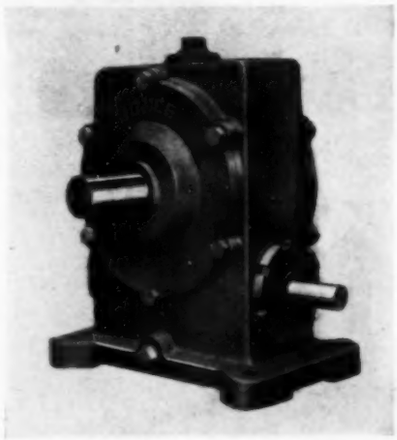
One of the most important uses of this tubing is for steel-backed bearings. Any specified thickness of bearing metal can be obtained, and since long lengths are available, bearings can be made economically in screw machines. The lining is cast into the tubing by a centrifugal process. The bond with the steel backing

is such that turnings made from the end of the tube will curl off the tool so that the spiral shows both textures of the bonded metals as one continuous strip without fracture at any point between the two. Among the lining materials already used are bronze, copper, tin, but almost any alloy or non-ferrous metal can be employed. The tubing can be lined with non-corrosive metals for conveying liquids and also for tubes used in water-tube boilers.

Jones Series OH Worm Gear Speed Reducers

Worm gear speed reducers in capacities up to 7 hp. have been placed on the market by the W. A. Jones Foundry & Machine Company, 4401 Roosevelt Road, Chicago, Ill. These Series OH reducers are built in ratios of 5 to 1 up to 50 to 1 and supplement the line of heavy-duty reducers. They are also built for right-angle drive.

The worm is a low-carbon, nickel-steel forging with the shaft integral



and hardened and ground. The worm gear is made of a nickel, phosphor-bronze alloy. A high-carbon steel forging is used for the gear shaft and is fitted with sling rings to prevent leakage of oil. As a matter of convenience and for universal application, the shaft is supplied in these standard units with a double projection. The reducer may, therefore, be connected from either side to the shaft of the driven machine, and this obviates the necessity of a right- or left-hand assembly. It also serves to drive two machines, one from each side. Both the worm shaft and the gear shaft are mounted on Timken roller bearings.

Automatic Sizing Device for Cincinnati No. 2 Centerless Grinder

Through the use of automatic sizing devices, it is now possible to grind cylindrical work on Cincinnati centerless grinders without the necessity of frequently checking the parts for accuracy or adjusting the feed wheel slide. What was formerly the task of the operator is now the job of the machine.

In the centerless method of grinding, the throat dimension between the grinding wheel and feed wheel determines the size of the piece being ground. As the wheels wear, the grinding throat becomes larger and accordingly the diameter of the work increases. The automatic sizing device advances the feed wheel in such a way as to maintain the throat dimension within extremely close limits.

The actual mechanism, developed by Cincinnati Grinders Incorporated, Cincinnati, Ohio, for keeping the work properly sized is relatively simple. As illustrated in Fig. 1, an electric contact gage is mounted on the rear of the work fixture. A closely adjusted gaging member is arranged so that as the diameter of the work increases due to wearing down of the grinding wheel, this gaging member contacts with the work and is carried along a considerable arc movement. By means of a small mercury switch mounted close to the pivot end of the gaging member, electric contact is made. The gaging member can be so adjusted that an increase in diameter of 0.0001 in. on the work will cause the electric contact to be made.

The electric contact energizes a solenoid connecting a valve on the feed mechanism (shown in Fig. 2) which, by hydraulic means, operates the infeed slide screw. Provision is made by means of a ratchet and pawl adjustment connected to the worm shaft to operate the feed slide nut, so that an infeed movement of the slide as fine as 0.0001 in. may be obtained.

An adjustable needle valve on the exhaust port is set to delay the return of the feed piston the necessary in-

Fig. 1—Rear of Cincinnati No. 2 Centerless Grinder, showing the electric contact gage for sizing work automatically

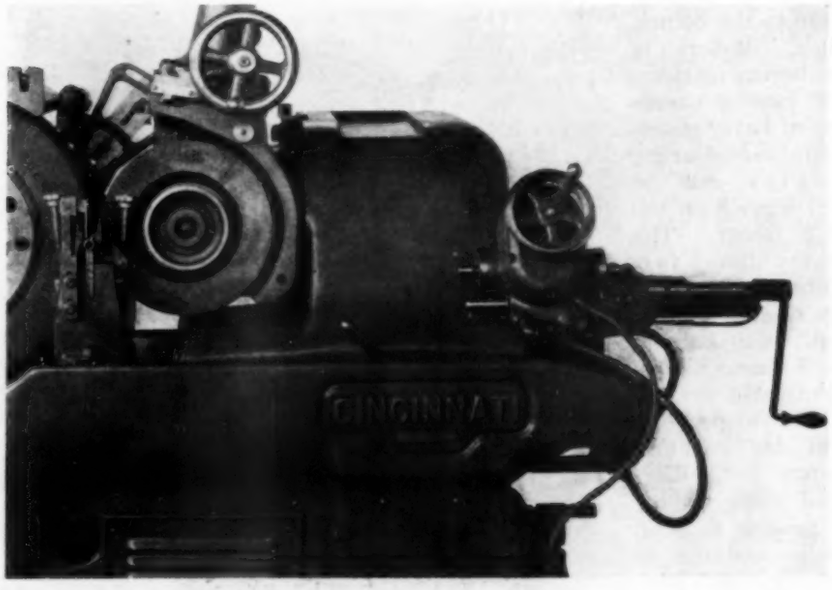


Fig. 2—Front view of Cincinnati Centerless Grinder, showing hydraulic infeed mechanism that is electrically controlled

terval so as to permit the work, which has been ground during this adjustment, to pass between the gage contacts. If the work is still large, the feed will operate again. However, if correct size is restored, the gaging member will return to normal position and contact will be broken, no further action of the feed mechanism taking place. All backlash on the feed screw is eliminated by means of a hydraulic cylinder attached to the machine bed.

This automatic sizing mechanism is available for standard Cincinnati No. 2 centerless grinders. It is constructed so that adjustments can be made for any angularity of blade and varying diameters of work. If desired, the gage may be made inoperative or entirely removed from the grinder.

By automatically sizing work during the roughing and semi-finishing grinding operations, a uniform stock removal on the finishing operations is obtained, thus insuring closer limits of accuracy.

Pels Plate Shear and Structural-Shape Cutter

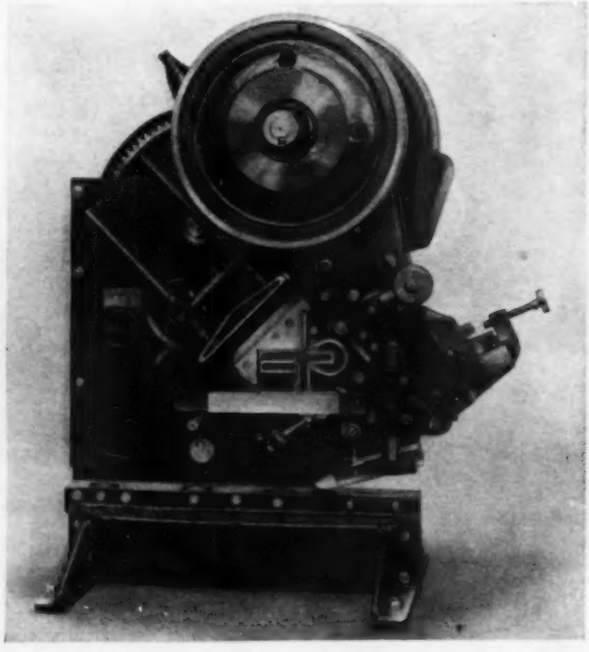
Shops fabricating welded machinery require facilities for cutting up plate and structural shapes, but often have no use for a punch. For this class of work, therefore, Henry Pels & Company, Inc., 90 West St., New York, N. Y., is offering two sizes of a plate shear and structural-shape cutter that are similar in all respects to its combination punch and shear, except, of course, that the punch has been omitted. These two machines correspond to the Types MA 13 and MA 16 units, but are known as the Types BMEFGE 13 and 16. The steel-plate frames of these machines are guaranteed to be unbreakable.

The plate shear has a crank and worm-operated hold-down, which is inclined towards the knives to come close to the cutting edge. Rollers in the horizontal channel facilitate feeding of heavy plates. Legs of large angles can be trimmed on the plate shear. The knives have four cutting edges each, are reversible at the top and bottom, and are interchangeable.

The angle, bar, and tee cutter moves on a diagonal slide, making it possible to bevel angles and tees in the horizontal position. Features comprise: Large knives, double spindle hold-down, removable graduated bevel gage, and quick substitution of special knives for beams, channels and other sections as desired. Angles are cut square and on the bevel, four ways, without adjustment of the knives. Flanges and stems of tees can be beveled.

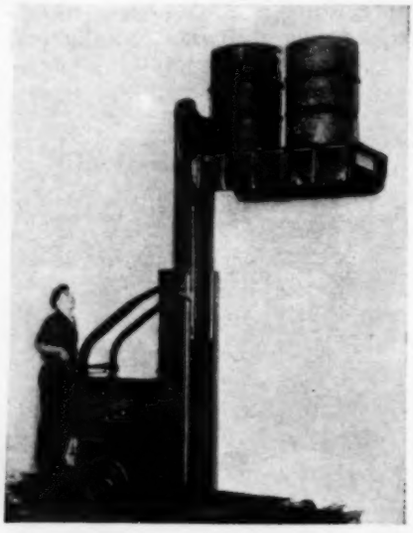
Specifications

Type — BMEFGE	13	16
Shears:		
Plate, any width, in.	$\frac{1}{2}$	$\frac{5}{8}$
Flats, in.	6x$\frac{1}{2}$	6x$\frac{3}{4}$
Trims plate, in.	$\frac{3}{8}$	$\frac{1}{2}$
Cuts:		
Angles and Tees, in.	5x4x$\frac{3}{8}$	6x4x$\frac{3}{8}$
Rounds, in.	$1\frac{3}{4}$	$2\frac{1}{8}$
Squares, in.	$1\frac{3}{8}$	$1\frac{7}{8}$
With special knives:		
Beams	6x12.5 lbs.	7x15.3 lbs.
Channels	7x12.25 lbs.	8x16.25 lbs.
Shear knives, in.	$10\frac{1}{4}$	12
Strokes per min., each tool	40	36
Hp. required	4	6
Net weight, lb.	3,600	5,150



Elwell-Parker Telescoping Lift Trucks

Economical storage is facilitated with the use of the electric telescoping lift trucks announced by the Elwell - Parker Electric Company, Cleveland, Ohio. Machines of the three- or four-wheel type are available, and capacities range as follows: 3,000, 4,000 and 6,000 lb. with 7- or 11-in. platforms. Capacity of the truck illustrated is 4,000 lb. It is 38-in. wide, 100-in. long, and has a 26x54-in. platform. It tiers in the



open to a height of 10 ft., and may be driven through a 7-ft. x 42-in. door.

This truck steers on all four rubber-tired wheels and operates in 70-in. aisles. The secondary uprights telescope or slide down inside the stationary uprights. The platform rises 61 in. above the floor before the sliding uprights begin to elevate. The advantage of this design is that the 61-in. lift may be had inside a box car before the sliding uprights elevate in the low head room. Standard automatic safety control of travel and hoist motors, a cable lift, and automatic elevating and hoist limit cutouts are features of this line of electric telescoping trucks.

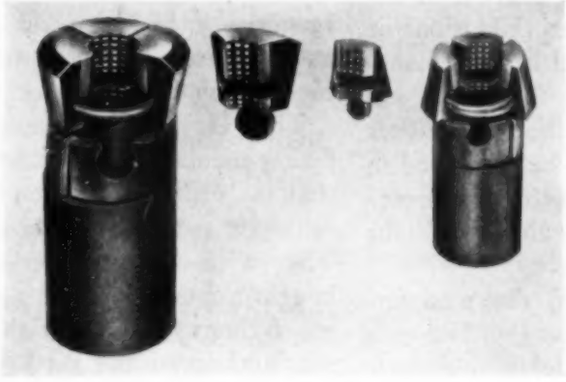
"Al-Lite" Chain Hoist

Aluminum alloys are used in the "Al-Lite" chain hoist announced by the Chisholm-Moore Hoist Corporation, Tonawanda, N. Y. The hoist, therefore, is one-third lighter than if

made of steel or malleable iron, has few parts, and is corrosion-resistant. Among its features are portability, Alemite lubrication, sturdy design, easy accessibility, hardened and ground ball bearings, planetary type gears, dust-proof housing, and adjustable brake.

"Highland Park" Equalizing Collets for Hot-Rolled Steel

The Highland Park Tool Company, 3801 Trenton Ave., Detroit, Mich., is offering equalizing collets for hot-rolled steel. These collets can be used in automatic screw machines for chucking hot-rolled steel that is out-of-round within the limits of steel mill tolerances. All parts are ground and fitted to be interchangeable, permitting renewal of worn-out parts and the substitution of a new pair of jaws when the size of work is changed. The back portion of the collet does not have to be removed from the collet tube when changing jaws from one work-hole size to another, thus saving time in set-up. The power required for chucking is less and consequently the chucking strain is reduced. Sizes are manufactured for hot-rolled stock up to 3 in.



PATENTS

MARCH 31, 1931

Metal-Working Machinery

Machine for Cutting Gears. Herbert Edgar Taylor, Coventry, England, assigned to Gleason Works. Patent 1,798,230.

Process for Making Rings for Springs. Frank B. Bell, Pittsburgh, and Byron W. Dunham, Oakmont, Pa., assigned to Edgewater Steel Co. Patent 1,798,301.

Four-Roll Hammer. William W. Criley, Cleveland, Ohio, assigned to The Ajax Manufacturing Co. Patent 1,798,309.

Board Hammer. William W. Criley, Cleveland, Ohio, assigned to The Ajax Manufacturing Co. Patent 1,798,310.

Machine for Casting Articles from Plastic or Liquid Masses. Jens Johanness Jensen, Copenhagen, Denmark, assigned to Boggild & Jacobsen, Copenhagen, Denmark. Patent 1,798,326.

Worm and Tap Grinder. Earle Buckingham, Belmont, Mass. Patent 1,798,832.

Threading Machine. Richard Lester Wilcox, Waterbury, Conn., assigned to The Waterbury Farrel Foundry & Machine Co. Patent 1,798,920.

Cutting Machine. Zenas P. Candee, Waterbury, Conn., assigned to The Waterbury Farrel Foundry & Machine Co. Patent 1,798,929.

Testing Machine. William C. Moran, Laurel Springs, N. J., assigned to Riehlé Bros. Testing Machine Co. Patent 1,798,948.

Riveting Machine. Heinrich Elsner, Dresden, Germany. Patent 1,798,976.

Lathe-Feed Mechanism. Carl W. Cherry, Carmel, Calif. Patent 1,799,038.

Ramming Machine for Forming Pipe Molds. Robert Ardelt, Eberswalde in the Mark, Germany. Patent 1,799,076.

Gear-Cutting Machine. Allan H. Candee, Rochester, N. Y., assigned to The Gleason Works. Patent 1,799,085.

Grinding Machine. Charles H. Lyne, Miami, Fla. Patent 1,799,109.

Tools and Attachments

Lathe Attachment. Hughes Louis Dardelet, Nantes, France, assigned to Dardelet Threadlock Corporation. Patent 1,798,143.

Soldering Torch. Lyle N. Dreibelbis, Los Angeles, Calif. Patent 1,798,195.

Transportable Grinding Machine. Wilhelm Rinau, Bremen, Germany. Patent 1,798,224.

Process of Making Spiral Reamers. James B. Dillard, Shaker Heights Village, Ohio, assigned to The Cleveland Twist Drill Co. Patent 1,798,314.

Die. Berthold A. Lange, St. Louis, Mo. Patent 1,798,475.

Gaging Machine and Gage. Max E. Berlowitz, Bellevelle, N. J., assigned to General Motors Corporation. Patent 1,798,650.

Stamping Device. Marcel Brugiere, Thiers, France. Patent 1,798,655.

Tool for Removing Broken Stud Bolts and the Like. Elmer F. Jackman, Wilkinsburg, Pa. Patent 1,798,944.

Furnaces

Electric Furnace. Gottlieb Keller, Brugg, Switzerland, assigned to Aktiengesellschaft Brown Boveri & Cie., Baden, Switzerland. Patent 1,798,678.

Furnace. Floyd C. Kelley, Schenectady, N. Y., assigned to General Electric Co. Patent 1,799,102.

TRADE PUBLICATIONS

BORING MACHINE. The Universal Boring Machine Co., Hudson, Mass., has published a bulletin No. 42 on its No. 50 horizontal boring machine, illustrating important assemblies and giving specifications.

GRINDER. L. V. Goebbels, 4419 Larchmont Ave., Philadelphia, Pa., has issued a pamphlet on the "Ace" surface grinder, recently described in these pages. The pamphlet gives complete information on the construction and the dimensions.

LINCOLN ARC WELDING PRIZE. The Lincoln Electric Co., Cleveland, Ohio, is distributing a pamphlet on the "Second Lincoln Arc Welding Prize Competition," which closes on October 1, 1931. The prizes total $17,500, of which the first prize is $7,500.

THREADING MACHINES. The Landis Machine Co., Waynesboro, Pa., has printed a catalog on its 1- and 1¼-in. "Landmaco" threading machines, giving complete constructional details and the specifications. Photographs of important assemblies are included.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, April 9, 1931

VOL. 74 NO. 15

A Plea for Sanity

AN EDITOR of another McGraw-Hill paper, who has been visiting business men and manufacturers in the Mississippi Valley and points west, brings back this arresting indictment of the East in general, and of Wall Street in particular. "When will you stuffed shirts in New York learn that business in this country is not entirely dependent on Wall Street? We had our depression and we are over it. We are busy, but the more you moan about depression the harder it is for us to keep up our enthusiasm. Gloom permeates. Forget it."

Here is a plea for sanity that deserves an honest answer. Unfortunately, although business a long way from Wall Street may be independent of it, the men who run business have acquired the habit of being personally involved. Consequently, they are affected by Wall Street psychology, and they let their personal worries cloud their business judgment.

If all business leaders would divert to their businesses the time they have been spending in stock speculation we should have an end to gloom and be much nearer full activity than we now are. The sooner we stop talking about depression and return to sanity the better it will be for every last one of us.

Parable

CAME a traveler from afar bearing in his hands plans, estimates, and specifications of a new machine tool. "Sire," said he to a manufacturer upon whom he chanced to call, "I am harbinger of a tool whose like thou hast never seen and whose worth can only be measured in rubies and fine gold. Yet I offer it thee for twenty thousand pieces of silver. Hast thou work for it to do?"

"Verily, and I have," replied the manufacturer, "much work. Believe it or not, I have a contract for thirty thousands of a certain intricate assembly per year. I can well see that thy machine will produce for me a saving of one piece of silver per assembly net, or thirty thousand per year—eight months operation will pay for it."

But the manufacturer had a comptroller and a banker and a board of directors who preferred a lot of hen-scratches in a ledger to a plant making a profit. Wearily did the traveler betake himself to the purchaser of the thirty thousand assemblies. "Sire," said he, "thy contractor is a smart man surrounded as an oasis by a desert of empty minds. He seeth that my machine will profit him thirty thousand honest smackers per annum at the present contract price; yet his comptroller, his banker, and his directors say him nay."

"Of a truth," replied the purchaser, "I smell dirt. Let us betake ourselves to the contractor and tell the old boy a thing or two. He in turn will state succinctly to his comptroller and his banker and his board of directors that they will authorize the machine and split the savings fifty-fifty with me—or out goes the contract."

In sooth, if our own particular hen scratches do not betray us, the contractor will still make a profit, but it will take sixteen months to pay for the machine instead of eight. This may be only a parable, but, substituting dollars for pieces of silver, the exact duplicate of the above transaction took place in these United States, A. D. 1931.

How to Discourage the Shop Management

A SHOP manager wanted to buy a machine to do a particular job on an electric motor. He knew he could cut costs on the piece, and he was sales-minded enough to believe that his company could get a certain order on the strength of this saving. But the absentee financial management of his company had decreed that no money was to be spent for capital investment. He couldn't buy the machine.

Then the machine salesman took it to a competing manufacturer, told him that he believed that the order in question could be secured if it could be put into production on this machine. The other manufacturer saw his opportunity, bought the machine, and got the order. Imagine the feelings of the first shop manager who was moving heaven and earth to keep his men!

I—Long-Term Planning of Business Operations

C—Carry this long-term planning into sales control, involving distribution methods, sales forecasting, and pricing.

(3) Know costs and stop selling at a loss. Maintain firm minimum prices based on production costs. (Business history shows a high degree of prosperity among those companies, large or small, which have had the courage to stand on a minimum price that insured a profit.)

GRAVEN on the tombstone of many a might-have-been-successful business should be the words, "We made sales, but no profits." For certain concerns departed from the ranks of the machine tool industry, the epitaph would be most apt; as Ernest F. DuBrul has pointed out, it is literally an industry that "makes its living by starving itself to death." Prices are too often set with the sole idea of bettering those of a competitor, or on a rough estimate of costs, not on the sound basis of actual production costs, minimum prices, and relative values.

Businesses are run primarily for profit. Business men cannot afford to delude themselves, by artful figure juggling, into believing that costs are lower than the facts warrant or that increasing the number of sales will do anything other than increase the total loss resulting from prices originally set too low. Reports of the Bureau of Internal Revenue suggest that about 45 per cent of American machinery manufacturers have been operating without profit for many years. In 1924, some 51.8 per cent of the machine tool and metal-working machinery firms reported no profit. Figures for 1926 and 1927 show that 39 and 40 per cent, respectively, of the factory machinery group had no profit. And these reports are for comparatively good years! What, then, would the reports show for 1930?

Again, thirty-five members of the National Machine Tool Builders' Association had a group ratio of profits to total assets of 6.4 per cent over an 11-year period, and ratios of 8.6 per cent between profits and net sales and 10.1 per cent between profits and net worth over the same period. Do these figures indicate accurate, sound costing, and the maintenance of "sound prices based on production costs"? Hardly! Yet these thirty-five are well above the average of machine-tool and machinery builders.

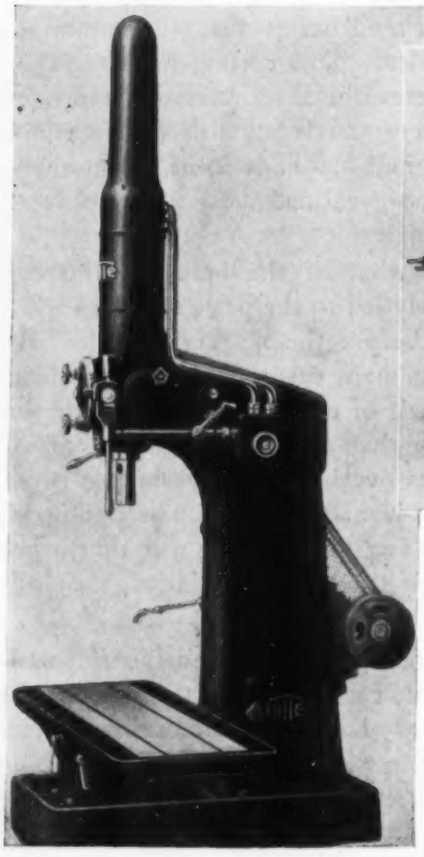
During the past several years, production costs have been increasing much more rapidly than prices. The result has inevitably been an ever-decreasing ratio of profit and consequent continual efforts to cut "overhead" in order to lower prices, under the delusion that this procedure would boost sales. This cutting has meant the lessening of research, market study, and most important, of cost analysis, with the inevitable result that the industry finds itself at the mercy of every business gyration.

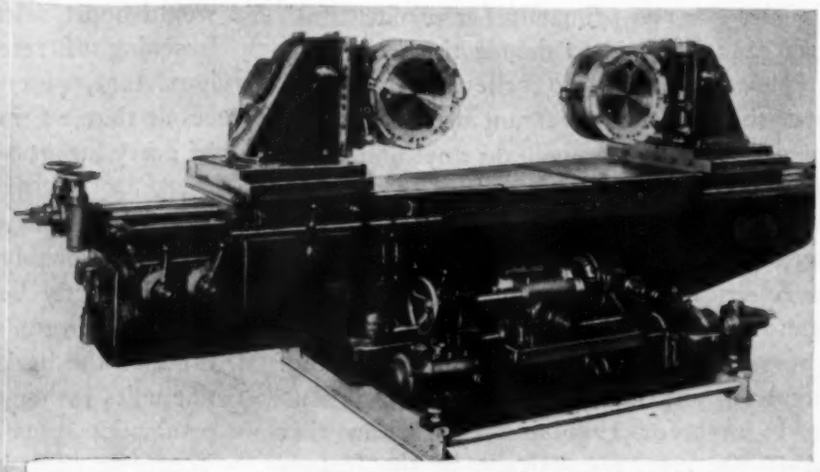
Tardy realization of the industry's insecure position probably led to the price increases which began shortly before the market debacle. But even now, in too many cases, price setting is being done on the basis of competitor's prices for similar units rather than on a basis of actual cost of production, plus overhead and reasonable profit. Where an effort is made to meet or beat another's price the result is a price-cutting war that brings good to none of those engaged in it.

It requires courage of an extraordinary sort to maintain prices in a period such as that which American industry has undergone during the past year, but only by so doing can an industry hope to avoid that epitaph, "We made sales, but no profits."

Products of some 200 companies were exhibited at this year's Leipzig Spring Fair. Increased use of hard cutting materials, advances in precision arrangements for tools, and the development of hydraulic drive and feed motions were notable, particularly the latter. The car-wheel lathe in the foreground, by Hegenscheidt, has a new type chuck with four equalizing jaws, relieving the pressure on the centers and avoiding damage to them. It may be used for wheel sets with roller bearings

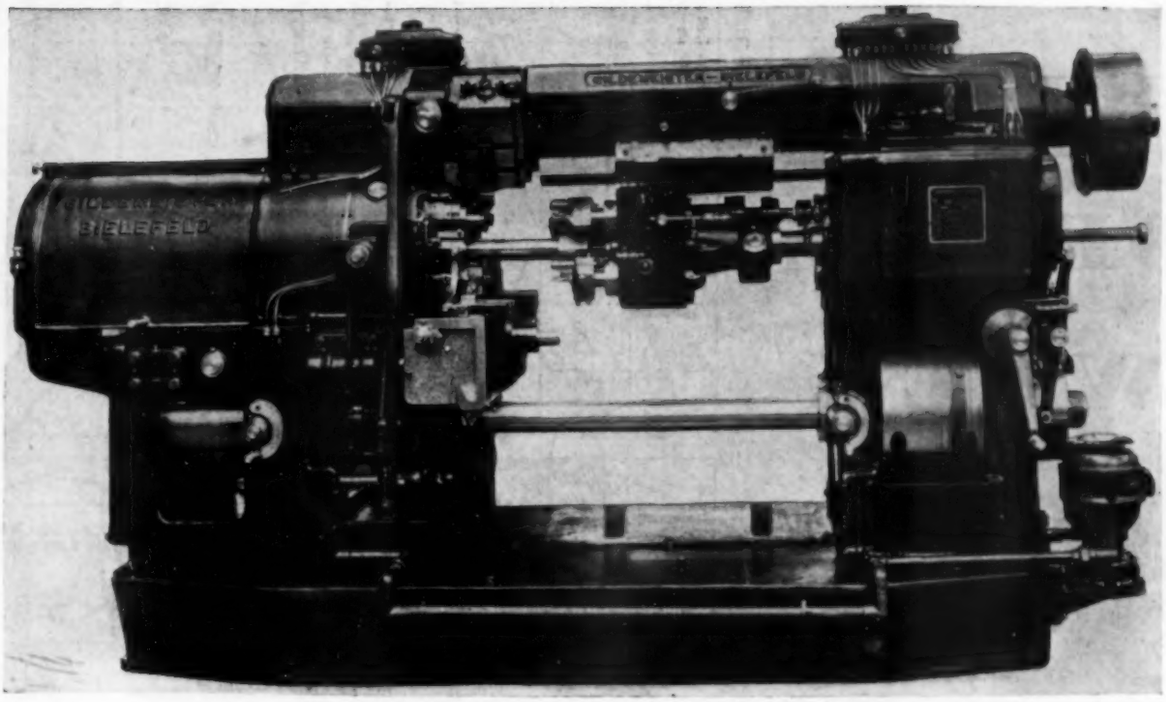
Machine Tools at the Leipzig Fair—I



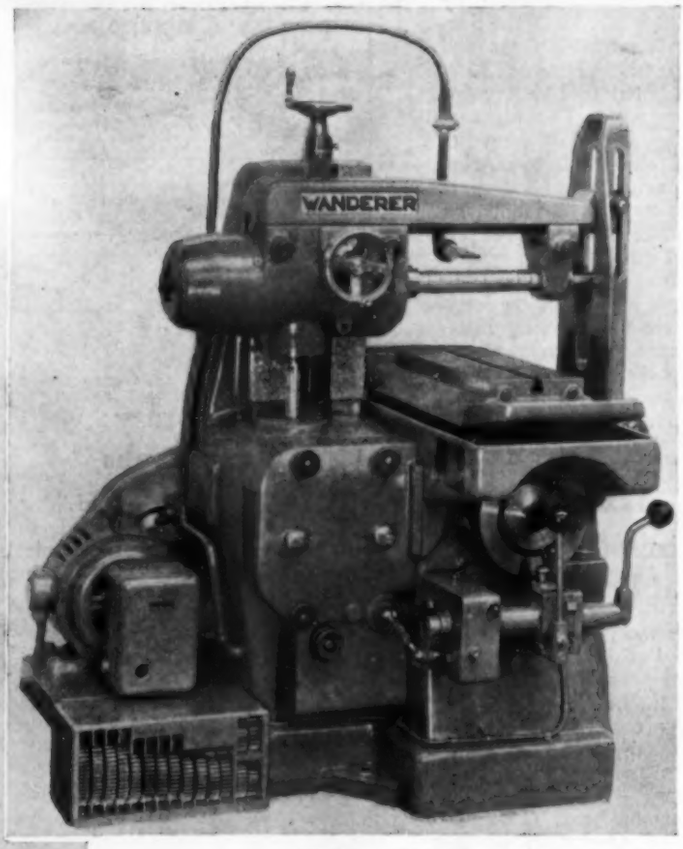


Stationary, duplex grinder for journal box pedestals of locomotives. The opposite pedestals are ground simultaneously by horizontal movement of the grinding motors. The feed motion is controllable without steps by hydraulic gearing. It was shown by Friedrich Schmaltz G.m.b.H.

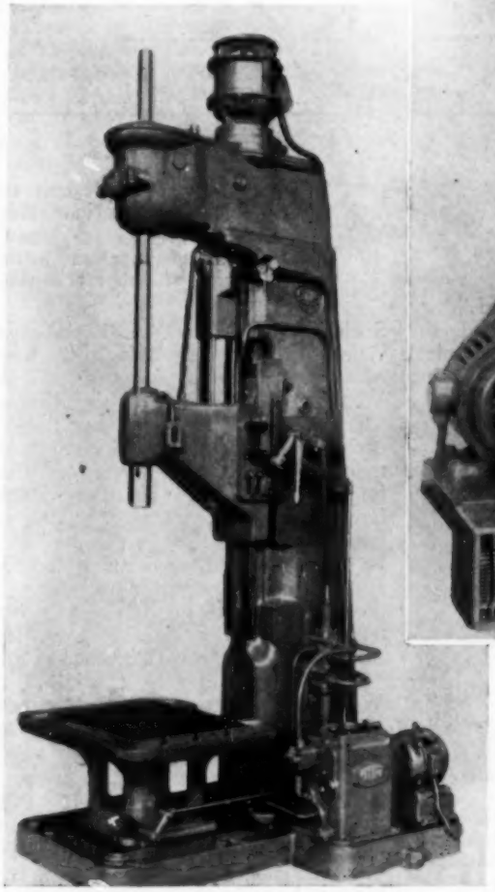
A vertical polishing machine with hydraulic feed motion and a moving table, planned by Hille-Werke for honing cylinder bores. For cylinder boring, a machine by the same company gives accuracy of 0.01 to 0.02 mm. (0.0004 to 0.0008 in.), preceding honing on the machine here shown



The Gildemeister 4- or 6-spindle pillar-type automatic has guides of spear-head shape above the tool posts, permitting shavings to fall freely. The arch, forming an overhead guide for the turret slide, reinforces the machine



Wanderer horizontal planer-type miller with drum-cam controlled table motion. A controlling disk with dogs for feed, rapid-traverse, and rapid-reverse table motions, is mounted on the front end of the drum



Hydraulic actuating of rapid forward and return feed motions were used on several drills shown on given speeds as high as 2.6 f.p.m. Special limit stops protect the tools on multi-spindle machines. This Hille-Werke unit has eight cutting speeds, and, incidentally, a flange-mounted motor

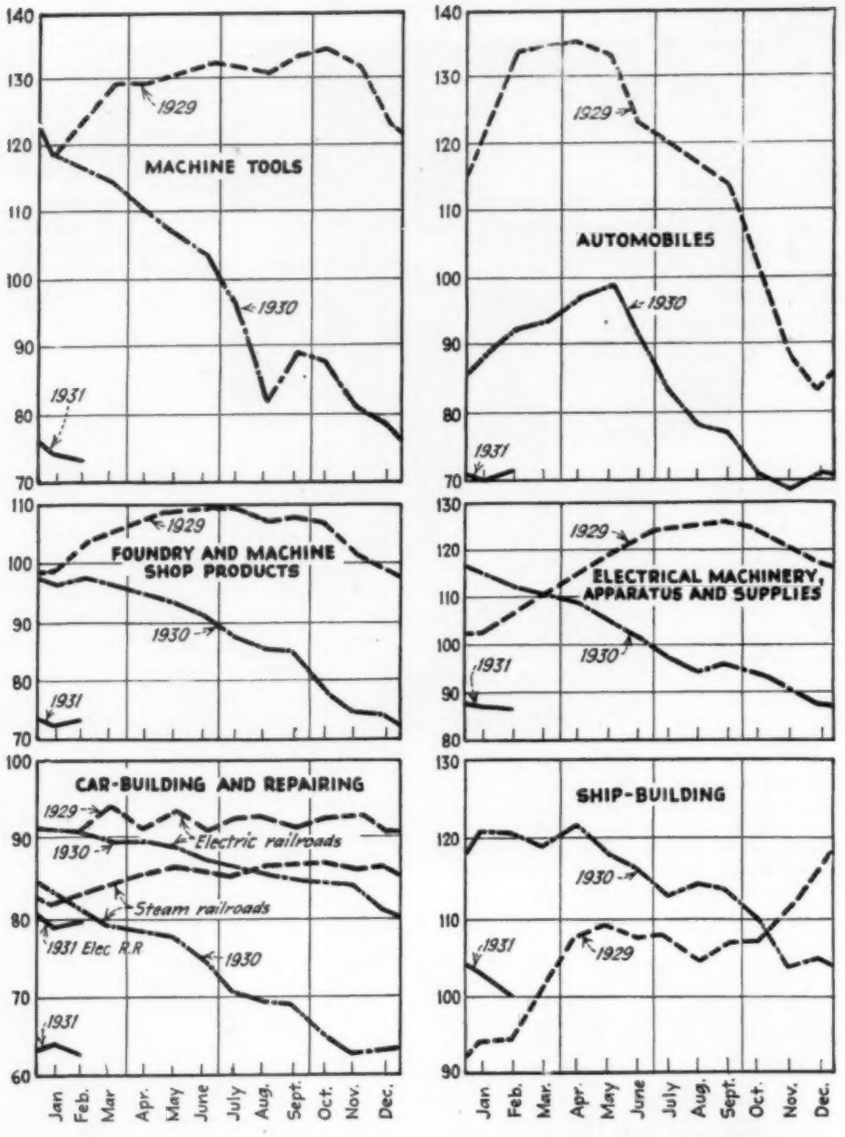
NEWS OF THE WEEK

Chuck Jaw Standards Proposed by A.S.M.E.

The proposed American Standard for Chucks and Chuck Jaws has been released recently in tentative form by Technical Committee No. 11 of the Sectional Committee on Small Tools and Machine Tool Elements of the A.S.M.E. It is being distributed to industry for criticism and comment. The proposal contemplates the standardization of chuck diameters, eleven sizes ranging from 6 to 36-in. having been fixed, gives in tabulated form dimensions for master jaws and removable top jaws, and covers some of the detail dimensions of certain other elements involved. Dimensions for master jaws and top jaws were determined with a view to obtaining interchangeability of the latter over a considerable range of chuck size. Copies of the tentative draft may be obtained from C. B. LePage, Assistant Secretary, A.S.M.E., 29 West 39th St., New York, N. Y.

A.S.M.E. Aircraft Meeting Scheduled at Baltimore

Included in the technical papers to be read and discussed at the Fifth National Technical Meeting of the Aeronautic Division, A.S.M.E., in Baltimore, from May 12 to 14, are: "Airplane Metal Developments", "Airports," "Airplane Communication", "Airplane Designs," "Airplane Engines," "Airship Developments," "Instruments and Piloting," "Management and Operation of Air Lines," and "General Developments." The plants of the Glenn L. Martin Co., the B/J Aircraft Corporation, and the Curtiss-Caproni Corporation will be visited on a series of inspection trips, as will the Baltimore Municipal Airport, Langley Field, Bolling Field of the U. S. Army Air Corps, and the Naval Air Station at Anacostia, near Washington.



Trend of Employment in Metal-Working Industries
Monthly average for 1926 = 100. Data supplied by the Bureau of Labor Statistics.

Engineering Library To Issue Monographs

The Engineering Societies Library has completed arrangements for the publication of a series of technical treatises to be known as "Engineering Societies Monographs." Editorial supervision of this series will be in the hands of a committee consisting of Harrison W. Craver, Director of the Library, Chairman, and two representatives of each of the four Founder Societies. The monograph will give in book form those important technical manuscripts which have proved too extensive, on the one hand, for publication in the periodicals or proceedings of engineering societies, and of too specialized a character, on the other hand, to justify ordinary commercial publication in book form. The first volume projected for the series is "Plasticity," by Dr. A. Nadai of the Westinghouse Research Laboratories. It will be an adapted and revised translation of Dr. Nadai's German treatise.

Carl A. Johnson
President, N.M.T.B.A., guest speaker, Westinghouse radio salute to machinery builders on April 26

FEDERAL Specification UU-P-226 on Drawing Paper, a proposed revision of Federal Specification No. 595, has been submitted to industry for criticism and comment.

Fifteen Technical Papers Scheduled At S.A.E. Aeronautic Meeting

FIFTEEN papers are to be presented at the six technical sessions of the Nineteenth National Aeronautic Meeting of the Society of Automotive Engineers. The meeting will be held at the Book-Cadillac Hotel, Detroit, on April 15 and 16, during the week of the International Aircraft Exposition there. Six papers, aside from those on fuels, are to be given for the aircraft-engine designer. The complete program lists the following papers: "Commercial Flight-Testing" by E. W. Rounds, of the Bureau of Aeronautics; "Fabrics in Aeronautics" by C. J. Cleary, of the United States Army Air Corps; "The Autogiro" by W. Laurence LePage, of the Kellett Aircraft Corporation; "Load Factors in Airplane Design" by R. V. Rhode, National Advisory Committee for Aeronautics; "High Temperature Liquid-Cooled Engines" by Arthur Nutt of the Wright Aeronautical Corporation; "Multi-Cylinder Low-Powered Light Engines" by R. N. Dubois, of the Continental Aircraft Co.; "Spark Plugs" by G. M. Paulson, of the B. G. Corporation; "A Novel Method of Studying Flying-Boat Hull Models" by Igor Sikorsky, of the Sikorsky Aviation Corporation; "Corrosion Prevention" by Lessiter Milburn, Glenn L. Martin Co.; "Superchargers and Supercharging" by Oscar Schey, of the National Advisory Committee for Aeronautics; "Bearing-Load Analysis and Permissible Loads" by F. L. Prescott and R. B. Poole, of the United States Army Air Corps, and "Airplane Fuel-Line Temperatures" by Dr. O. C. Bridgeman, of the Bureau of Standards.

Because of the difficulties and misunderstandings that have arisen in the past with the knock rating of aviation gasoline, the Aircraft-Engine Committee has distributed to various laboratories for test work, samples of gasolines of five different specifications. The knock-rating experiments on these gasolines and the results obtained will be co-ordinated into a paper to be given by H. K. Cummings, of the Bureau of Standards. The results of rating of these gasolines by flight testing will be given at the same session in a second paper by a representative of the Pratt & Whitney Aircraft Company, to be followed by a report on further laboratory tests and data on knock-rating by Dr. Graham Edgar, of the Ethyl Gasoline Corporation, the data being the result of co-operative work by several of the well-known testing laboratories.

The aircraft banquet will be held at 6:30 p.m. on Thursday.

Welding Society Announces Annual Meeting Papers

PAPERS to be presented at the annual meeting of the American Welding Society from April 22-25 at the Engineering Societies Bldg., New York City, have been announced as follows:

WEDNESDAY, APRIL 22

Morning—TECHNICAL SESSION —SHIPBUILDING

"Welded Boilers for U. S. Navy Scout Cruisers," by J. C. Hodge, Barberton Works, Babcock & Wilcox Co.

"Welded Machinery Foundations for Ships," by G. H. Moore, Jr., Newport News Shipbuilding & Dry Dock Co.

Afternoon—TECHNICAL SESSION STRUCTURAL STEEL

"Some Examples of Welding in Structural Steel Work," by D. C. Tennant, Structural Engineer, Dominion Bridge Co.

"Formulae for Eccentrically Welded Connections," by Odd Albert, Bridge Designer, New Jersey Highway Commission.

"Some Tests of Gas-Welded Structural Joints," by H. H. Moss, Linde Air Products Co.

THURSDAY, APRIL 23

Morning—TECHNICAL SESSION

"Some Resistance Welding Problems," by C. L. Pfeiffer, Western Electric Co.

"Strength and Characteristics of Various Types of Connections for Static and Dynamic Loadings," by C. H. Jennings, Westinghouse Electric & Manufacturing Co.

"Fusion Welding as Applied to High-Pressure Heat Exchangers," by Marselis Powell, Whitlock Coil Pipe Co.

FRANCIS HODGKINSON
Westinghouse consulting engineer 1931 winner, Willans Premium

Afternoon—TECHNICAL SESSION—PIPING

Joint meeting with Pressure Piping Code Committee of American Standards Association. Presentation and discussion of proposed section of code dealing with welding of pressure piping by subcommittee of the American Welding Society.

"Welding of Heating and Industrial Piping," by J. H. Zink, Chairman, Committee on Welding, Heating, and Piping Contractors' National Association.

Evening—TENTH ANNUAL DINNER

FRIDAY, APRIL 24

Morning—TECHNICAL SESSION

"Thermit Welding in Maintenance in the Steel Mill," by J. H. Deppeler, Chief Engineer, Metal & Thermit Corporation.

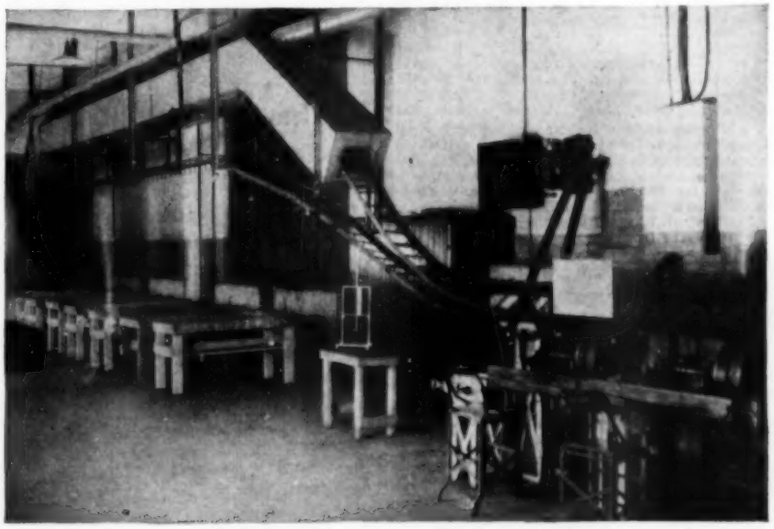
"Metal Arc-Welding of Copper Alloys," by Ira T. Hook, American Brass Co.

"High Tensile Atomic Hydrogen Arc Welds in Alloy Steels," by Frederick Ray, Consulting Engineer, Croll-Reynolds Engineering Company.

Afternoon—
STRUCTURAL STEEL WELDING COMMITTEE AND AMERICAN BUREAU OF WELDING

Report and analysis of test data by the Structural Steel Welding Committee.

Report of progress made by various research committees of the Bureau. Election of Officers, Appointment of Executive Committee.



Continuous spring tempering oven ceiling mounted and gas-fired, at the plant of the U. S. Bedding Co. The oven, built by Despatch, is 30 ft. long, and operates at 400-650 deg. F.

UNITING the scientific, educational, industrial, and social work forces striving to prevent blindness and conserve vision throughout the country, the National Society for the Prevention of Blindness has placed in the mail in New York the first issue of its new quarterly journal, "The Sight-Saving Review."

Revised Data on Small Tools Released by Bureau

WASHINGTON, D. C., April 5.—The Bureau of the Census announces that, according to a revised tabulation of data collected in the Census of Manufactures taken in 1930, the total value (at f.o.b. factory prices) of machine-tool accessories and small metal-working tools manufactured in the United States in 1929 amounted to $167,230,319. Of this total, $94,027,541 was contributed by attachments and fixtures and $73,202,778 by small tools. The leading item is $45,584,660, representing the value of subpresses, punches, dies, etc. Of the total, $134,565,862 was reported by establishments engaged primarily in the manufacture of machine-tool accessories and small metal-working tools, and the remaining $32,664,457 represents the value of such accessories and tools made as secondary products by establishments engaged primarily in the manufacture of machine tools and of stamped ware, enameled ware, metal stamping, and similar products.

This industry, as defined for census purposes, embraces establishments whose principal products are twist-drills, reamers, milling cutters, taps, dies, etc., and establishments specializing in the building of dies, jigs, fixtures, and special tools.

Preliminary statistics on the industry appeared in *American Machinist*, Jan. 1, on page 36a.

TABLE 1—SUMMARY FOR THE INDUSTRY: 1929

	Industry as a Whole	Attachments and Fixtures	Small Tools
Number of establishments	722	591	131
Wage earners (average for the year)[1]	26,666	15,935	10,731
Wages[2]	$51,084,540	$34,409,177	$16,675,363
Cost of materials, fuel, and purchased electric current[2]	$26,992,597	$15,073,455	$11,919,142
Value of products[2]	$144,410,890	$86,859,175	$57,551,715
Value added by manufacture[3]	$117,418,293	$71,785,720	$45,632,573

[1] Not including salaried employees.
[2] Manufacturers' profits can not be calculated from the census figures because no data are collected for certain expense items, such as interest on investment, rent, depreciation, taxes, insurance, and advertising.
[3] Value of products less cost of materials, fuel, and purchased electric current.

Statistics for the industry are summarized in Table 1.

TABLE 2—MACHINE-TOOL ACCESSORIES AND SMALL METAL-WORKING TOOLS—PRODUCTION, BY CLASS AND VALUE: 1929

Class	1929
Machine-tool accessories and small metal-working tools made in all industries, aggregate value	$167,230,319
Machine-tool accessories and small metal-working tools made in the industry	$134,565,862
Made as secondary products in "Machine Tools" and "Stamped ware, enameled ware, and metal stamping, enameling, japanning, and lacquering" industries[1]	$32,664,457
Attachments and fixtures, total value	$94,027,541
General equipment:	
Chucks (lathe)	2,725,483
Chucks (drill)	1,309,913
Chucks (magnetic)	326,254
Jaws (face plate)	88,512
Die heads (threading)	718,600
Dividing heads	20,265
Vises (machine)	182,232
All other	46,259
Special equipment:	
Jigs and fixtures	19,762,019
Punch-press equipment—	
Subpresses, punches, dies, etc.	45,584,660
Die-casting and drop-forging dies	1,232,754
Tools for screw and automatic Machines—	
Box tools, hollow Mills, work and tool holders, etc	4,046,307
Specially designed tools	5,652,279
Special machinery	5,066,984
Special order work not reported by kind	1,780,973
All other attachments and fixtures	5,484,047
Small tools, total value	73,202,778
Arbors and collars	278,167
Collets	343,342
Counterbores	1,116,719
Countersinks	65,222
Drills (carbon)	4,096,029
Drills (high speed)	9,911,434
Hobbing cutters (high speed)	2,078,916
Lathe tools (carbon)	457,177
Lathe tools (high speed)	683,466
Milling cutters (carbon)	558,463
Milling cutters (high speed)	10,146,063
Reamers (carbon)	3,114,356
Reamers (high speed)	5,042,556
Saw blades	292,615
Threading tools:	
Taps and dies (not pipe threading)—	
Taps (carbon)	3,526,272
Taps (high speed)	3,069,694
Dies (carbon)	1,337,119
Dies (high speed)	1,362,676
Chasers	3,251,469
Pipe threading—	
Taps	300,435
Dies	1,346,867
Pipe stocks complete with dies	2,338,528
All other small tools	11,595,495
Precision measuring tools and gauges	5,870,807
Other measuring tools	1,018,891

[1] In addition, machine tool accessories and small metal-working tools are made to some extent as secondary products in still other industries, but this production is unimportant. The final report will include data for the secondary production of these commodities in all industries.

Washington Expects Prompt Business Stimulation

PAUL WOOTON
Washington Correspondent

WASHINGTON expects business to be stimulated by the position the President has taken against tax increases. His determination to block any move for higher taxes is evidenced by his suggestion that the public must bring the weight of its influence to bear upon legislators.

There is no doubt that the administration can carry on without particular embarrassment in the face of a diminishing income. Treasury operations can meet the situation. In that connection it is pointed out that the $700,000,000 deficit is not a deficit in the ordinary commercial understanding of the term. Bonus payments really constitute a loan at 4½ per cent against a liability of the Treasury. Expenditures for plant and equipments in private business would not be classed as a deficit but as an investment. Appropriations made the Farm Board would not be regarded by a private corporation as a gross expenditure. It might write down the value of its holdings in wheat and cotton, but it would include in its year's expenditures nothing more than that deduction.

Washington is more interested in the report that the British have a customs union plan than it is in the German-Austrian program. It is recognized that the labor government would have a constructive alternative proposition were it to advocate a natural economic alliance instead of the imperial preference which it opposes. Reciprocity with Argentina, for instance, would mean more to the British than reciprocity with Australia, It also would be of more concern to the United States.

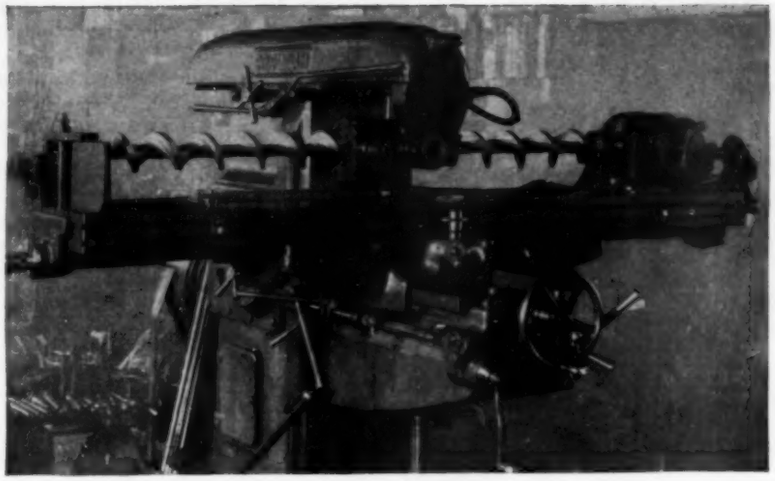
Washington is taking very seriously the trend toward customs unions. In fact, the original Briand proposal for a united states of Europe was taken more seriously in the Capital than in commercial centers. Since it is apparent that there is no way of stopping trade reciprocity, none in Washington will be surprised to see France follow suit by establishing such a union with the Balkan countries that come within its sphere.

Objections by other nations to the German-Austrian customs agreement are regarded by many observers in Washington as preposterous impertinence. Attempts to read great political significance into what is very obviously a business-like effort to do something to relieve Austria's desperation and Germany's distress is condemned as over-stepping the bounds of propriety.

France and Belgium did practically the same thing but no furore was raised. Certainly a step which carries with it a promise of benefit to 73,000,000 people should not be twisted into a political issue, it is thought. The United States has an interest in the matter, as it is a sign of returning sanity and will do something toward pulling the world out of its depression.

"Industrial Engineering" Changes Name

Industrial Engineering, one of the McGraw-Hill publications, becomes *Maintenance Engineering*, with the April, 1931, issue. The purpose of the change in name is to express correctly the editorial objective, which is to serve the men responsible for the function of maintenance in industrial plants, to tell them what to do, how to do it, and what to do it with. There will be no change in the type of editorial content, past editorial efforts having been devoted to the maintenance function as it will be treated under the new name. Its readers are maintenance engineers, plant engineers, master mechanics, chief electricians, superintendents of maintenance and others in the maintenance engineering staffs throughout industry.



Cutting a screw conveyor pattern from a 5-in. steel bar. Center diameter was 1½ in. and length 71 in., while the table travel of the Cincinnati No. 5 miller was but 50 in. The piece was set up as shown, being reversed to finish after one end was cut to the full extent of table travel. Spiral mills were used, and a special steady rest

French Machine Tool Production Steadily Being Concentrated

PARIS, April 2—France is showing signs of diminishing prosperity, so far as buying capacity is concerned. The unemployment figure is vague, but seeming authority has put it at 300,000. It may be more. Counting part-time workers, the figure jumps to a million or more, according to some authorities. No slogan of "business is as good as you make it" is likely to change the status. Even though the intensity of the drop is actually slowing down, the barometer is nevertheless falling. What the low limit will be no one seems able to predict.

Demand for consumer goods has been such that neither stockers of raw material from abroad or manufacturers of home-made goods are in a position which would warrant increasing inventories. Furthermore, France is greatly concerned by unemployment conditions in England and Germany, foreseeing that in order to give their nationals work, producing capital or consumer goods, something very akin to dumping is bound to take place. France and Germany are on the eve of stabilizing their mutual tariffs and commercial agreements, taking the lead in a Europe-wide movement which counts at least a dozen other countries. If it comes to pass for a year or three-year period, we shall see a European line-up against America.

Machine tool production in France is concentrating to an even greater extent in the hands of the larger, better, and older established firms. The weeding out of the less capable will give a freer hand to the old-line firms, and perhaps, lead to a rise in prices which will be of benefit to the American industry selling its product in this market. The untoward effect of this readjustment has been a slight shock to the industry in that a flood of second-hand tools is now a feature of the market. This, in more than one way, will affect new equipment, from whatever source it is sought.

Whether born of jealousy, envy, or a sense of martyrdom there is much live comment in trade circles in general as to the profits which American, English, and Germans and getting from trading with the Soviets. The chief point emphasized is that Germany has increased its export of lathes in the Russian market from a value of 17 million Moscow rubles in 1929 to 47 millions in 1930, and on long-term credits running from 14 to 29 months, after 20 per cent has first been paid on account in the form of short-term acceptances.

German exports to France during 1930 may be tabulated as follows:

	Value in francs
Machine tools	415,000,000
Electrical equipment and machinery	265,000,000
Textile machinery	250,000,000
Hoisting machinery	150,000,000
Other, not specified	130,000,000
Agricultural machinery	105,000,000
Motors	84,000,000
Printing machinery	75,000,000

French exports in 1931 fell 54 per cent to the United States, 17 per cent to Germany, and 7 per cent to Great Britain. If trade between nations is rightly considered as the only true money of exchange, it is obvious that if, or when, the powers wake to a realization of the situation, a real reason will be found for any dimunition of exports to France. That this is near, may be a debatable point, but the issue is framing all over Europe, so far as trading with the United States is concerned, that to sell abroad one must buy abroad.

French imports of machinery in 1930 were divided as follows: From Germany, 66%; Belgium-Luxembourg, 9.5%; Great Britain, 8%; United States 5.4%; and Switzerland, 4%. One may marvel at these percentages, but they are French official computations applied to "machines and articles in metal." The total valuation of 4,320,000,000 francs is ten time that of any pre-war year. Basing this on the coefficient of 5, as representing today's value of the franc, and the figure still doubles itself.

Wholesale metal prices have fallen from the index figure of 437 in December last to 423 as of March 1, 1931, a drop of 8 points more than that of the general index. Since there are no figures which would indicate the index of transformed metal prices, this might suggest that a push is being made to keep the wheels of the fabricating and transforming industries turning at the possible expense of the metallurgical branch. Imported products of all kinds, during the same three months, have lowered their index but 2 points.

Living costs have not fallen so that the wage-earner would notice it. Actually, in 1930, they increased from 565 to 597. This may be taken as an indication that it is an economic impossibility to reduce the generalized wage bill, in spite of the argument of the employer that it is either that or short time. This condition is already in evidence in certain districts and in certain industries.

Spring Sectional Meeting Of New England A.S.S.T.

A full-day program of technical papers and plant visitations has been planned for the Spring Sectional Meeting, April 14, at Hartford, of the New England chapters of the A.S.S.T. Two papers are to be presented at the technical session, including, "The X-Ray in the Metal Industry," by E. W. Page, and, "Recent Developments in Nitriding," by Dr. Victor O. Homerberg. The afternoon will be occupied by inspection trips to the Pratt & Whitney Co., the Pratt & Whitney Aircraft Co., and the Chance Vought Corporation. Dr. Zay Jeffries will speak on "The Metallurgist in Industry" at the dinner that evening.

National Chamber Meets April 28-May 1

The Nineteenth Annual Meeting of the United States Chamber of Commerce will be held for four days, April 28 to May 1, at Atlantic City, N. J. Two full afternoons during the four-day meeting will be devoted to round-table discussions on immediate issues. Included in the round-table schedule are such subjects as "Competition in Transportation," "Foreign Trade Recovery," "Stabilizing Industrial Employment," and "Present Opportunities for the Trade Associations."

BUSINESS ITEMS

The Lincoln Electric Co., Cleveland, Ohio, has moved its Chicago office to a new and larger building at 1455 West 37th St.

At a meeting of the board of directors of the Canadian Ohmer, Ltd., of Montreal, the following officers were elected: president and treasurer, H. B. Ohmer; vice-president, R. L. Hubler; secretary, H. W. Baker; assistant treasurer, R. M. Ohmer; and managing director, H. J. Sibley. The company is now the Canadian distributor for the Ohmer Fare Register Co., Dayton, Ohio, but plans are being formulated for manufacturing some of the Ohmer products in Canada.

Veeder-Root, Inc., has recently signed a contract with the Automatic Signal Corporation in New Haven, Conn., to manufacture important parts of their automatic traffic dispatching apparatus over a long term. The units will be manufactured at the Bristol plant of the Veeder-Root Company.

The western office of the Ohio Seamless Tube Co., Shelby, Ohio, has been moved to 1225 West Washington Blvd., Chicago.

The Northern Engineering Works, 210 Chene St., Detroit, Mich., has opened an office in the Fidelity Bldg., 1940 East Sixth St., Cleveland, Ohio.

Mayer & Oswald, 332 South LaSalle St., Chicago, Ill., have been appointed sales representatives in the Chicago district, of the Meriam Co., 1955 West 112th Street, Cleveland, Ohio.

Amended articles of incorporation of the Clinton (Ia.) Bridge Works have increased capital stock of that concern from $50,000 to $300,000, represented in 1,000 preferred and 2,000 common shares.

The Ford Motor Co., has opened a new assembly plant at 414 West Broadway, Salt Lake City, Utah.

C. D. Hobbs & Co., Ltd., has been incorporated by British Columbia charter with head office at Vancouver, B. C. Authorized capital is $50,000. The company is empowered to manufacture and deal in machinery, iron and steel.

The General Car & Coach Co., Glens Falls, N. Y., has leased the plant there of the former Arrow Grip Manufacturing Co. Oliver F. Warhus is president and general manager.

Announcement of the organization of the Marmon-Herrington Co. has been made through filing of papers of incorporation with the Indiana secretary of state. G. M. Williams, President of the Marmon Motor Car Co., stated that this new company will be a subsidiary unit for the purpose of making multiple-drive commercial vehicles of a highly specialized type. The new subsidiary will be headed by Mr. Williams as President. F. E. Moskovics will be chairman of the board. A. W. Herrington will be vice-president and chief engineer, and W. C. Marmon, board chairman of the parent company, will be a director.

The Minneapolis-Moline Power Implement Co., Minneapolis, Minn., has established a factory-distributing branch at District Blvd. and Everett Ave., Los Angeles, Calif.

The Alloy Metal Wire Co., Inc., Moore, Pa., has installed a 4-high rolling mill for the production of cold rolled strip in widths up to 16 in., and thicknesses from $\frac{1}{4}$ in. to 0.003 in. The new mill is capable of handling stainless steel strip, wire, and rod for all purposes.

PERSONALS

George S. Brady, Associate Editor of *American Machinist* and Managing Editor of *Product Engineering*, lead the discussion on "Product Design for Increased Utility and Improved Marketability" at an informal management conference of the Metropolitan Section, A.S.M.E., in the Engineering Societies Bldg., New York City, on April 3. George W. Kelsey, of the Joseph Dixon Crucible Co., acted as chairman.

George G. Landis, in charge of electrical and mechanical design of motors and arc-welders for the Lincoln Electric Co., Cleveland, Ohio, has been made chief engineer. He has been with Lincoln for the last eight years.

R. W. Appleton, formerly director of purchases of the Pierce-Arrow Motor Car Co., Buffalo, N. Y., has been appointed purchasing agent for the Morse Chain Co., Ithaca, N. Y., and Detroit, a subsidiary of the Borg-Warner Corporation, Chicago.

Walter W. Bertram has been appointed sales manager of the Industrial Chain Division, Morse Chain Co., Ithaca, N. Y.

C. R. Cady, formerly foundry engineer for Frank D. Chase, Inc., and now with the engineering department of the National Engineering Co., Chicago, spoke on the "Building of a Large Tractor Foundry in Russia," at the April 2 meeting of the Chicago Foundrymen's Club. William Romanoff, Technical Superintendent of the H. Kramer Co., Chicago, spoke on the "Brass Ingot in the Non-Ferrous Foundry."

Frank M. Brinkerhoff has been appointed consulting engineer co-operating with the committee on research in freight car design of the American Railway Car Institute, 61 Broadway, New York City. Mr. Brinkerhoff has been an associate of L. B. Stillwell for 20 years, as consulting engineer specializing in car design.

Fred G. Brost, Superintendent for the past 25 years of the Lancaster (N. Y.) Machine & Knife Works, resigned April 1 to retire from active business. Howard Strite was appointed to succeed Mr. Brost.

Charles E. Curtis has been elected president and treasurer of the Western Iron Stores Co., Milwaukee, assuming most of the duties of Ralph M. Friend, who died early in February. W. W. Ethier is vice-president and general manager, Wm. C. Mueller, secretary, and C. W. Krueger, sales manager.

F. C. Dierks, Secretary of Fairbanks, Morse & Co., Chicago, has been elected a director. W. E. Miller and F. M. Boughey have resigned from the board.

Frank Farrell has resigned as assistant general superintendent of Steel & Tubes, Inc., a subsidiary of the Republic Steel Corporation. Youngstown, Ohio.

Dr. Lillian Gilbreth of Gilbreth, Inc., Montclair, N. J., spoke on "Fatigue in Industry" at the April 8 meeting of the New Britain Local Section, A.S.M.E.

J. F. McClelland has recently been elected a vice-president of the Phelps-Dodge Corporation, New York.

W. Roy Moore, identified with the Billings & Spencer Co., Hartford, Conn., for the past 17 years, has been made general manager.

Edward C. Bullard, Vice-President and Director of the Bullard Co., Bridgeport, Conn., has been appointed general manager to succeed his uncle, the late Stanley Hale Bullard. Mr. Bullard is the first of the third generation of the family to assume so important a position in the organization. He became associated with the Bullard Co., in 1917 and was made assistant to his father, Dudley B. Bullard, Chief Engineer, in 1926. Three years later he was appointed an engineer in charge of design and research, and in 1930 was elected a vice-president.

CHARLES E. STUART
President and Treasurer,
Tyson Roller Bearing Corporation

Glenn Merrefield, formerly foundry superintendent of the Clark Equipment Co., Buchanan, Mich., has resigned to take a similar position with the Pettibone-Mulliken Co., Chicago.

H. E. Rose, identified for the past four years with the Weaver Bros. Co., Adrian, Mich., has resigned to become a manufacturers' agent specializing in metal pickling equipment, with headquarters at 11902 Phillips Ave., Cleveland, Ohio.

Rene von Schleinitz, formerly secretary-treasurer and now a director of the Harnischfeger Corporation, Milwaukee, has returned after a year's visit to foreign markets.

Hon. Gordon W. Scott, partner in the firm of P. S. Ross & Sons, Montreal, since 1914, has been appointed a director of Canadian Tube & Steel Products, Ltd., Montreal.

F. H. Terwin, of the Technical Department Staff, Vacuum Oil Co., New York City, will speak on "Practical Industrial Lubrication" at the April meeting of the Anthracite-Lehigh Valley local section, A.S.M.E.

John D. Tyson, formerly assistant metallurgical engineer, Standard Steel Works Co., Burnham, Pa., has been appointed chief metallurgist.

Walter H. Wiewel has been made sales manager of the Timken Steel & Tube Co., Canton, Ohio, replacing A. J. Sanford, resigned.

W. C. Witt, Chicago branch sales manager for the Lakeside Bridge & Steel Co., Milwaukee, since 1921, has been appointed general sales manager of A. C. Woods & Co., Rockford, Ill.

OBITUARIES

Fred L. Bryant, 75, formerly president of the Chicago Metal Works, died March 30 at his home there.

John J. Alvord, 72, founder of the Atlas Shear Co., now the Acme Shear Co., Bridgeport, Conn., died March 31 at Mount Dora, Fla. Mr. Alvord was president and general manager of the firm for nearly 30 years until it was taken over by the Acme concern.

Maurice D. Brown, formerly plant superintendent of the National Conduit & Cable Co., died of pneumonia in Yonkers, N. Y., on March 22.

Roy G. Carter, Secretary of the Sibley Machine Co., South Bend Ind., for 21 years, died March 20.

W. H. Cavnah, Secretary-Treasurer of the Canton (Ohio) Foundry & Machine Co., died March 20.

Charles A. Collins, 53, Vice-President of the Hanna Co., and president of the Hanna Furnace Co., Cleveland, Ohio, died of pneumonia April 1 there.

John Henry Iwan, 89, senior partner for 54 years of Iwan Bros., South Bend, Ind., died recently.

George A. Lance, 81, head of the Lance Machine Shop & Foundry, Watertown, N. Y., died March 31 of heart disease.

Stanley A. Mallette, 61, President of the American Car & Foundry Co., New York City, died March 30 at his home in Scarsdale, N. Y., after a short illness.

Charles B. Waters, President of the Waters Arc Welding Co., New York City, died suddenly of heart disease, April 3 at his home in Montclair, N. J.

Joseph Dove-Smith, 76, founder and president of Dove-Smith & Son, Niagara Falls, N. Y., specializing in the designing and construction of machinery of all kinds, died last week at his home there following a six-month illness. Mr. Dove-Smith came to this country from England in 1911.

Charles A. Haag, 48, Assistant Superintendent of the Syracuse Washing Machine Corporation, died in Syracuse, N. Y., March 25.

Henry D. Laughlin, 83, who helped reorganize the National Hollow Brake Beam Co. in Chicago in 1888 and who has been active throughout his entire life in the railroad equipment industry, died recently at Ashland, Wis. He had retired some time ago.

Andrew Lawton, 77, at one time superintendent of the Republic Iron & Steel Co., Youngstown, Ohio, died of heart disease, March 13.

John Thomas McGrath, 61, for the past 18 years inventor and manufacturer of railway appliances in Bloomington, Ill., founder of the firm of J. T. McGrath & Son Co., 215 East Douglas St., Bloomington, died March 27 in that city after an illness of a year and a half.

Philip O. Schleussner, 53, First Vice-President and director of Roessler & Hasslacher Chemical Co., Inc., Niagara Falls, N. Y., died March 21 at his home in Stamford, Conn.

FORTHCOMING MEETINGS

THREE-M-CONGRESS — Management, Maintenance, and Materials Handling Congress and Second National Industrial Equipment Exposition, Cleveland, Ohio, April 13-18. 1931. In the Arena and Exhibit Hall, Cleveland Public Auditorium. Information from the A.S.M.E., 29 West 39th St., N.Y.C.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

Semi-Annual meeting, Birmingham, Ala., Apr. 20-23, 1931.

National Aeronautic Meeting, Baltimore, Md., May 12-14, 1931.

National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

AMERICAN WELDING SOCIETY—Annual Meeting, April 22-24, New York City. M. M. Kelly, 33 West 39th St., New York, Secretary.

STEEL FOUNDERS' SOCIETY OF AMERICA — Monthly Meeting. Pittsburgh, April 23. Granville P. Rogers, 432 Graybar Bldg., New York City, Managing Director.

AMERICAN FOUNDRYMEN'S ASSOCIATION—Annual convention and exhibition, Stevens Hotel, Chicago, May 4-8, 1931, C. E. Hoyt, 222 West Adams St., Chicago, secretary.

SOCIETY OF AUTOMOTIVE ENGINEERS —Annual Spring Production Meeting, May 7-8 at Hotel Schroeder, Milwaukee. J. A. C. Warner, 29 West 39th St., New York, N. Y., Secretary.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION—Annual Spring Meeting, Hotel Statler, Buffalo, May 7-9, 1931. T. W. Owen, 3608 Euclid Ave., Cleveland, secretary.

AMERICAN STEEL & HEAVY HARDWARE ASSOCIATION — Twenty-second Annual Convention, May 18-20, William Penn Hotel, Pittsburgh. B. R. Sackett, 505 Arch St., Philadelphia, Secretary.

NATIONAL FOREIGN TRADE COUNCIL —Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION—Annual Conference, Production Division, Rochester, N. Y., June 1-2. Headquarters, 20 Vesey St., N. Y. C.

NATIONAL ASSOCIATION OF PURCHASING AGENTS—Annual Convention and Informashow, Royal York Hotel, Toronto, Canada, June 8-11. G. A. Renard, 11 Park Place, New York.

NATIONAL ASSOCIATION OF FOREMEN —Eighth Annual Convention, Biltmore Hotel, Dayton, Ohio, June 12-13. Detailed information from the National Association of Foremen, Refiners Bldg., Dayton, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., New York, N. Y., secretary.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

UPWARD, slowly, falteringly, and uncertainly, but none-the-less upward, sales of machine tools fight their way in the country's markets. The upward course of general business is taking its usual long period to filter through to machine tools, and prospects are caressingly, devotedly, fondly, gazing at every nickel before they part with it. Export orders are helping out, however, and the price structure is being maintained in the face of declines in commodity prices.

NEW YORK tool sales are spotty, some resulting indirectly from Pennsylvania Railroad's recent purchases of locomotives and other 1931 railroad commitments. Milwaukee had a March better than January, which was the previous high point, with railroads and electrical manufacturing concerns considered best current prospects. Southern District sales are continuing fair, but used tool sales are decidedly slow. Philadelphia also shows a March improvement over February, with orders including a substantial one from Philco Radio. New England, however, is pessimistic, in spite of several good orders and maintenance of previous sales advances. Textile interests promise most at this time.

CLEVELAND tool sales showed an upward spurt last week. Automotive accessory concerns are buying, and other sales are being made. Chicago is disappointed in that the upturn forecast for March failed to materialize and that present conditions are static. Cincinnati manufacturers generally report no change, an opinion agreed to by dealers, although both expect some improvement this month. Detroit general business is better, but machine tools sales are still marking time.

NEW YORK

The continuing rise of general business is having only slight effect upon machine tool sales here. Inquiries, as such, are discounted by dealers, since practically all of the business now being placed is the result of continued and persistent efforts by salesmen, sales managers, vice-presidents—in fact anyone who can be brought in to assist in landing orders. Even the most extravagant Scotch stories pale into insignificance beside the determined head-shaking of prospects, who deep down in their hearts know as well as the salesmen that they need the equipment. March for most dealers was equal to January, in some cases was the year's best month, in others second best. The same is true of last week. Several dealers had a good week, one at least a very good week. Amtorg bought another batch of tools, and recent Pennsylvania locomotive orders are resulting in occasional tool purchases by the recipients. The Pennsylvania Railroad ordered some $7,500,000 worth of steel, and reports showed March automobile production, exclusive of Ford, the best in 10 months.

MILWAUKEE

Continued improvement is reported by local machinery and machine tool manufacturers, although the increase varies from slight to good. All agree, however, that only by hard work and concentrated selling efforts have results been obtained. March volume was considerably higher than that of February and December and also above January, which ranked second of the four months. Selling agents are also much encouraged.

Railroads and electrical manufacturing concerns are considered the best current prospects. In addition to the Pennsylvania, the Great Northern, Milwaukee, and Santa Fe are expected to place shop equipment business. Allis-Chalmers, General Electric, and Westinghouse are also looked to for business.

SOUTHERN DISTRICT

Sales of machinery and machine tools the past fortnight continued fair. Steady, but scattered buying, has resulted in a generally satisfactory condition in point of volume. There is relatively little inquiry for used tools and machinery. Absolutely necessary replacements on limited appropriations appear to be the only reason for demand of used types at all. Trade-ins have been watched carefully with a view to maintaining satisfactory stocks of used equipment. Keen competition, however, does affect this phase of the business more than could be desired.

Building operations throughout the area have shown some improvement; that is, as they have affected the machinery trade. The brightest spots are in the South Central area, with an extreme dullness prevailing in Florida to a slightly better condition in the Birmingham and Atlanta districts.

PHILADELPHIA

An improvement in the general tone in the machinery and machine tool industry was noted by some dealers and manufacturers during the last two weeks. Generally speaking, March showed an improvement over the preceding month. With an improvement in the number and quality of inquiries, there was a distinctly better feeling.

One firm reported a rather substantial order from the Philco Radio concern, and there were other orders from industrial firms for lathes, milling machines, and radial drills. Another reported it had just closed for a small machine tool, the order for which had been pending since last May.

NEW ENGLAND

Machine tool orders do not bear out prospective promise. Recent gains as a whole are fairly well maintained, yet some centers reflect absolute dullness. The week was practically featureless. A central Massachusetts company, however, has closed on a fair volume of special machinery. Springfield, Mass., is receiving bids for metal-working and wood-working machinery, and Boston anticipates a similar move shortly. New England railroads are taking only an occasional machine, but inquiry from outside sources in this field shows some promise.

At this moment the textile industry shapes up as most interesting. As anticipated in previous letters, really astonishing strides have been made since the first of the year, resulting in somewhat freer buying of machine tools. In view of the hand-to-mouth policy in recent years, this industry may be regarded as a promising potential market.

CLEVELAND

Sales of machine tools showed an encouraging spurt last week. March closed with a flourish, according to one dealer. Orders indicated that buying is becoming more general. Automotive accessory concerns made substantial purchases. Sales of small items showed good activity. Punch and shear, boring mill, lathe, and automatic manufacturers report an upward trend in the last two weeks. New inquiries are increasing and are on a more liberal scale.

February proved to be the best month of the first quarter. January sales were fair, while March dropped beneath February. The first quarter of 1931 shows improvement over the last quarter of 1930. A 31 per cent gain in employment by industrial concerns over February is reported.

CHICAGO

March business in the machine tool industry was disappointing in that the pick-up generally forecast failed to materialize. Almost without exception, manufacturers' representatives and selling agents report conditions as static, and hesitate to express themselves with respect to the future. The slight upward trend noted last week has not been maintained. For the first time in several weeks no railroad inquiries were received, and closing on lists now in the hands of the trade is deplorably slow. From what can be gathered, industrial demand shows no tendency to improve, even necessary replacements being postponed until general production rises to a higher level.

CINCINNATI

A few machine tool manufacturers had a shade better business than in the preceding week, but the majority report no change in the demand. Some see indications of at least a slight business upswing through the month; none express the pessimistic view that demand will reach a lower level. Selling agents note no change in market conditions, but express the opinion that considerable pending business will be closed in the next few weeks. To a very large extent the week's business was single tools and replacements, but here and there was an order for two or three units. Business was well scattered over the country and requirements were well diversified as to sizes and types. Principal buyers were miscellaneous industrial users and general machinists. Inquiries were fairly numerous.

DETROIT

Automobile sales continue to increase, rumors of model changes pile up, optimism is spreading, and general conditions are improving; but the machinery trade is still marking time. The sure signs of returning prosperity are heartening to machinery and machine tool dealers, but they do not represent cash in hand. Orders are still small in number and in size; inquiries are interesting and encouraging, but seldom definite. Salesmen are working harder than they ever worked before and by sheer force of persistency are obtaining a fair amount of business.

Figures for March show little improvement over February and the general level for the first quarter will be only a little above the average for all of 1930. In isolated cases this is not true, but for the most part the volume is unimpressive.

At the rate of improvement now being shown by automobile and accessory manufacturers, capacity will probably be reached some time in the second quarter. This estimate, taken in conjunction with the announced plan of manufacturers to bring out all models in the fall, lead the machinery men to believe the last part of the second quarter will mark a substantial improvement in the trade.

BUSINESS • BAROMETER

Business is greatly confused by the multiplicity and inconsistency of reports

THEODORE H. PRICE
Editor, Commerce and Finance, New York

AWIT has suggested that Einstein should repeal the law of cause and effect. One is reminded of this proposal by last week's markets. They seem to be entirely without "pep," although the week's developments were not especially discouraging. It is hard to explain the apparent anomaly, unless it be due to President Hoover's announcement that he had no authority over the Federal Farm Board, whose findings were in much the same category as those of the Interstate Commerce Commission.

This announcement has aroused some fear that an effort to sell the grain and cotton held by the Farm Board might shortly be made. Such an effort would, of course, lead to a severe break in the markets, and it is almost inconceivable that it should even be considered. But there are some who seem willing to believe anything of the Federal Farm Board, and the present nervousness will continue until an irrevocable statement of a policy that the Farm Board intends to follow is issued. Speculation in commodities as well as in securities is meantime restrained, and the resulting impatience is causing great dissatisfaction as well as some loss.

It is evident that we must get back on an even keel and an unobstructed course if the ship of business is to make its customary progress during the coming summer. To this end it is suggested that all business men should write the Federal Farm Board at Washington, D. C., urging that the course it intends to pursue should be promptly announced and followed without deviation for the next six months.

Business is greatly confused by the multiplicity and inconsistency of the press notices published, as no one can be sure of the facts. The news that has been published is not, however, entirely satisfactory. The net earnings of 65 Class A railways decreased 51 per cent for February, and railroad stocks have been concurrently weak. Sales in R. H. Macy's New York store for the year 1930 amounted to over $99,000,000. This is an amazingly large total, and although the increase over 1929 is hardly more than one-half of one per cent, prices of course were considerably lower.

Nor is the outlook overseas entirely cloudless. It is hoped that, by his visit to London, Gandhi may succeed in ironing out all the wrinkles in the Anglo-Indian situation. There are, however, some pessimists who doubt this, and it is quite possible that the conference may be punctured by political differences of opinion that will be hard to smooth over. The Australian Government has guaranteed the provincial bonds of the Commonwealth whose holders feared that they might not get the interest due April 1. It is hard to believe that a community so thoroughly Anglo-Saxon will be a party to any default. The situation is, nevertheless, harrassing to Great Britain, who is straining her financial resources in order to meet her many obligations with promptitude.

THE BUSINESS WEEK

April 8, 1931

The beginning of the second quarter brings no break in the monotonous movement of business along the bottom on which it has been bumping for five months. . . . The spring stimulus has been scarcely more than seasonal, and our index, after allowance for this factor, so far shows no certain sign of rise from a level about 20% below normal. . . . Steel has lost a little of its momentum, as it usually does after March, and automobile output is increasingly cautious. . . . But electric power production reflects a slow growth in general industrial activity, construction is encouragingly active, and carloadings suggest an increasing movement of merchandise for spring trade. . . . Best of all, the drought is routed and crops are promising. . . . But declining stock and commodity prices, weakening bond markets and chronic credit contraction show continued lack of business and banking confidence here and abroad. . . . Although a critical period for early business recovery is approaching, there is still no hint of any major move to hasten it. . . . With all Europe embarked upon an international "race for starvation" through wage-cutting, and our financial interests still seeking salvation overseas rather than in domestic development, American standards hang in the balance and need bracing with a bit of business backbone.

©The Business Week

In South America there has been a default in the bonds of Peru. More or less nervousness in regard to the financial situation in Brazil is also discernible, and Montagu Norman, Governor of the Bank of England, is over here on a mission which the *quid nuncs* associate with South American finance. No one knows the facts, but it is assumed that Mr. Norman wants to find a way to check the flow of gold to this country. By the latest report of the Federal Reserve Banks, the amount of gold now held in this country is $4,689,000,000. No other nation has ever held so much of the yellow metal, and it is not surprising that our control of it should cause more or less nervousness amongst the world's financiers. One result of the accumulation is that gold has declined slightly in London.

The foregoing summary of conditions on both sides of the Atlantic as well as in the Southern Hemisphere is brought into relief because it is encouraging in that its effect upon general business everywhere has been but slight. The only explanation that can be offered is that people have come to realize that economy is the road to wealth, that it is better to save than to spend, and that the surplus earnings of business and industry in the United States are being rapidly invested under conditions that will show a substantial profit to those who are now able to buy.

It is true that the unemployment situation is serious, but jobs are somewhat easier to obtain, and with the advent of spring there ought to be work for everyone who is sincerely anxious for it. Distributive trade is improving. This is especially true of shoes and cotton goods. No one can say just why there should be an unusual demand for shoes just now, but most dealers admit an increase of sales. Staple commodities have fluctuated but little; but one or two show slight declines. The changes, however, are not important, and large consumers of rubber, coffee, sugar, silk, and hides are said to be anticipating their requirements. One very important automobile corporation has formally announced the adoption of this policy. It is expected that the example set will be widely followed, and a summer of relatively good business appears to be indicated, despite the puzzling policy that the Federal Farm Board seems disposed to follow.

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THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

THE new mill-base of $1.70 per 100 lb. for steel at Pittsburgh, remains untested. Sheet prices on mill lots are a bit steadier and yet these were the most unstable of all. Nevertheless, none of the consuming agents is taking steel in anything approaching large tonnages, except in the case of structurals and rein. bars for construction purposes. Warehouse business is now lagging in practically all metal products. No advances occurred during the week, in prices of shop materials listed here. Declines affected steel from warehouse, copper, zinc, fabricated brass and copper, solder, babbitt metal, scrap-crucible copper and waste.

(*All prices as of Apr.* 3, 1931)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.69@$15.19
Tenn. Foundry (Silicon, 1.75@2.25)	14.69@ 15.19
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	18.25
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	12.00@13.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	17.76
Virginia No. 2 (Silicon, 1.75@2.25)	17 75
Basic	17.75
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.01
PITTSBURGH:	
No. 2 Foundry	18.13@18.63
Basic	18.13@18.63
Bessemer	18.63@19.13

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4.75
Chicago	4.50@4.75

STEEL SHEETS—Prices are in cents per lb. for sheets from warehouse stock except at Pittsburgh mill, where prices apply on large lots:

Blue Annealed*	Pittsburgh Mill	Chicago	Cleveland	New York
No. 10	1.90	3.35†	3.00	3.20‡
No. 12	1.95	3.45†	3.10	3.25‡
No. 14	2.05	3.55†	3.20	3.30‡
No. 16	2.15	3.65†	3.30	3.40‡
Black				
Nos. 18 to 20	2.15	3.60†	3.40	3.30
No. 22	2.30	3.75†	3.55	3.45
No. 24	2.35	3.80†	3.60	3.50
No. 26	2.45	3.90†	3.70	3.60
No. 28	2.60	4.05†	3.85	3.75
Galvanized				
No. 10	2.20	3.65†	3.50	3.35
Nos. 12 to 14	2.30	3.75†	3.60	3.40
No. 16	2.40	3.85†	3.70	3.50
No. 18	2.55	4.00†	3.85	3.65
No. 20	2.70	4.15†	4.00	3.80
No. 22	2.75	4.20†	4.05	3.85
No. 24	2.90	4.35†	4.20	4.00
No. 26	3.15	4.60†	4.35	4.25
No. 28	3.40	4.85†	4.70	4.50

*Light Plates. †400 to 3,999 lb. ‡1,000 to 3,999 lb., ordered and released for shipment at one time.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

List prices on which foregoing discounts apply, are as follows:

Size, Inches	List Price per Foot	Diameter in Inches External	Diameter in Inches Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.275	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.585	2.875	2.469	.203
3	.765	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness Inches	B.w.g.	Outside Diameter ½	⅝	¾	⅞	1	1¼	1½
		Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049	18	.17	.18	.19	.20	.21	.23	.25
.065	16	.19	.20	.21	.22	.23	.25	.27
.083	14	.20	.22	.23	.24	.25	.27	.29
.095	13	.21	.23	.25	.26	.27	.29	.31
.109	12	.22	.24	.26	.27	.28	.30	.32
.120 or .125	11	.23	.25	.27	.28	.29	.31	.33
.134	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	7.00	6.00	6.15
Hoop steel	3.55†	4.00	3.65†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.65†	5.00	5.00†
Cold fin., round or hexagon‡	3.40	3.40	3.35
Cold fin., flat or square‡	3.90	3.90	3.85
Structural shapes	2.90†	2.95	3.00†
Soft steel bars and bar shapes	2.90†	2.95	2.90†
Soft steel bands	3.20†	3.20	3.10†
Rivets, structural or boiler	4.25	....	4.00
Tank plates	2.90†	2.90	3.00†
Bar iron (2.75 at mill)	2.90†	3.00	2.90†
Drill rod (from list)	65%	55%	60%

*Flat, 5/16-in. thick by ¾-in. wide. †Minimum, Chicago, 400 lb., New York, 1,000 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—3/32, 8.35c. per lb.; ⅛, 7.85c. per lb.; 5/32 to ¼, 7.35c. per lb.

METALS

Warehouse Delivery Prices in Cents Per Lb. for Small Lots:

Copper, electrolytic, New York			11.00
Tin, Straits, pigs, New York			29.50
Lead, pigs, E. St. Louis	4.25	New York	5.50
Zinc, slabs, E. St. Louis	3.95	New York	5.50

	New York	Cleveland	Chicago
Antimony, slabs	10.00	10.25	10.75
Copper sheets*	19.87½	19.87½	19.87½
Copper wire*	11.75	11.87½	11.87½
Copper, drawn, round*	18.37½	18.37½	18.37½
Copper tubing*	22.37½	22.37½	22.37½
Brass sheets, high*	17.25	17.25	17.25
Brass tubing, high*	22.12½	22.12½	22.12½
Brass rods, high*	15.50	15.50	15.50
Brass wire, high*	17.75	17.75	17.75

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%†	24.00	24.30	23.30
Zinc sheets (casks)	9.75	11.25	10.36
Solder (½ and ½)	21.75	21.50	18@20

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade	44.75
Commercial genuine, intermediate grade	33.75
Anti-friction metal, general service	29.00
No. 4 babbitt, f.o.b.	10.00

†F.O.B.

NICKEL AND MONEL METAL—Prices in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	7.75	7.75	6.75@ 7.25
Copper, heavy, and wire	7.25	7.50	6.25@ 6.75
Copper, light, and bottoms	6.25	6.50	5.50@ 6.00
Heavy lead	3.25	3.50	2.50@ 3.00
Lead battery plates	1.25	2.50	1.75@ 1.87½
Brass, heavy, yellow	4.25	4.50	4.00@ 4.25
Brass, heavy, red	6.75	7.00	5.75@ 6.25
Brass, light	3.50	3.25	3.25@ 3.75
No. 1 rod-brass turnings	4.50	4.50	4.00@ 4.50
Zinc	1.25	1.50	1.25@ 1.50

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07@$0.11	$0.16	$0.13
Cotton waste, colored, per lb.	.05½@.09	.12	.09
Wiping cloths, washed, white, per lb.	.15	38.00 per M	.14½
Sal soda, per lb.	.01½	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.098	.099	.104
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.75	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	50%
Med. grade, heavy wgt.	30%	30 –5%	40%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	70%	50–10%	60%
Second grade	65–5%	60– 5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.029	$0.031	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.155	.1587½	.2125
Solder (½ and ½)	per lb.	.2175	.22	.285
Cotton waste, white	per lb.	.07@.11	.13	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.75	.75	.75
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65–10%	65–10%	50–10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville,		2.50
Coke, prompt foundry, per net ton	Connellsville,		3.25
White lead, dry	100 lb. kegs	New York,	13.25
White lead, in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from list, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65–10%
Larger, up to 1 x 30-in., full kegs, list less	65–10%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65–10%
Larger, list less	65–10%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.25
Structural, round head, broken kegs, net	5.75
Tank, 7/16-in. dia. and smaller, list less	60–10%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65–10%
Larger, up to 3-in., list less	65–10%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$3.50
Wrought, broken kegs, per 100 lb., list less	1.50
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$8.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal—will receive bids until April 21 for overhead electric traveling crane.

Mass., Boston—P. O. Box 1658 — Michle vetrtical machine.

Mass., Cambridge (Boston P. O.) — New Method Die Co., 30 Cross St.—power punch press, 12 in. throat.

Mass., Reading—P. O. Box 96—bench lathe, power press, milling machine, shaper, hand screw machinery and general equipment for light manufacturing.

Mass., Springfield—Dept. of Public Buildings, H. L. Dorman, Supt.—metal working and woodworking equipment, etc., for Van Sickle School.

R. I., Newport—Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.—will receive bids until April 21 for one band saw, 36 in. motor driven, Shed 5484.

Opportunities for Future Business

Calif., Oakland—Art Tool & Dye Works, 1020 60th St., plans construction of a 1 story, 15 x 23 x 90 ft. machine shop at 60th St. near Idaho St.

Calif., Oakland—G. E. Wollgren, 1083 Jones Ave., plans the construction of a 15 x 25 x 40 ft. machine shop at 1083 Jones Ave.

Calif., Riverside—Constructing Quartermaster, received lowest bid for the construction of a garage, two warehouses, etc., at March Field, from Bannister-Field, Inc., 4101 Goodwin Ave., Los Angeles. $151,652.

Calif., San Francisco—Macdonald & Kahn, Financial Center Bldg., postponed indefinitely construction of a 2 story garage at Folsom and Main Sts. $300,000. Noted Dec. 11.

Conn., Cheshire — Connecticut Reformatory, will build a shop for the manufacture of automobile markers. Estimated cost $40,000. Private plans. Work will be done by inmates. Noted Mar. 5.

Conn., Hartford—Chamber of Commerce, J. B. Slimmon, Chn., Aviation Committee, is having plans prepared for the construction of a 100 x 120 ft. hangar to include workshop. Estimated cost $35,000. I. A. Allen & Son Inc., 100 Farmington Ave., Archts. Interstate Airways Inc., lessee. Equipment for workshop will be required.

Idaho, Lewiston—Union Pacific Stages Inc., awarded contract for the construction of a 1 story, 100 x 100 ft. bus terminal and garage. Estimated cost $35,000.

Ill., East St. Louis—B. F. Goodrich Rubber Co., 500 South Main St., Akron, O., awarded contract for the design and construction of a service station here. Estimated cost $50,000.

Ia., Des Moines—Wheeling Corrugating Co., Washington St. and 20th Ave. E. manufacturers of corrugated metal culverts and other metal specialties, awarded contract for a 1 story, 60 x 80 ft. shop building at 7th St. and Raccoon Ave.

Md., Baltimore—Edward Katzinger Co., 1959 North Cicero Ave., Chicago, Ill., awarded contract for the construction of a plant for the manufacture of bakers' tinware, etc., here. Estimated cost $60,000. City Motor Sales Co., 460 South Slate St., lessee.

Mass., Dorchester (Boston P.O.)—J. A. Singarella, Park Sq. Bldg., Boston, will build 1 story, 50 x 105 ft. garage, etc., at Mount Vernon St. here. Estimated cost $45,000. Work will be done by separate contracts.

Mass., Falmouth—Cape God Auto Co. Inc., F. Young, Jr., Mgr., awarded contract for the construction of a garage on Depot Ave. Estimated cost $40,000.

Mass., Longmeadow — Town, E. F. Smith, Town Hall, is having plans prepared for a 1 story, 60 x 135 ft. shop and storage building on Pondside Rd. Estimated cost $40,000. R. M. Mowry, 25 Harrison Ave., Springfield, Archt.

Mass., Malden (Boston P.O.)—Eastern Auto Parts Co., 182 Eastern Ave., awarded contract for a 1 story, 75 x 90 ft. addition to service station, etc. Estimated cost $40,000.

Mass., Springfield—A. Bondi, 101 Lyman St., plans the construction of a 2 story sales and service station on Taylor St. Estimated cost $120,000. Architect not selected.

Mass., Worcester—Dept. of Public Works, will receive bids in April for the construction of a 3 story, 50 x 175 ft. shop at East Worcester St. Estimated cost $150,000. R. G. Gorrani, 175 Green St., Archt.

Minn., Minneapolis — Sanitary Mattress Co., Broadway and Central Ave. N. E., awarded contract for a 2 story, 48 x 126 ft. addition to plant. Estimated cost including equipment $30,000.

Minn., South St. Paul—Swift & Co., Packers and Exchange Aves., (meat packers) are having plans prepared for a 4 story, 125 x 224 ft. repair and service garage here.

N. H., Milford—Souhegan Motor Co., c/o A. W. Osberg, 795 Elm St., Manchester, Archt., will soon receive bids for addition and alterations to 2 story, 50 x 105 ft. garage here. Estimated cost $40,000. Noted Mar. 19.

N. J., Bordentown—Dept. of Institutions & Agencies, State House Annex, Trenton, is having sketches made for the construction of a 2 story industrial school here. Estimated cost $150,000. Guilbert & Betelle, 20 Branford Pl., Newark, Archts.

N. J., East Rutherford (br. Rutherford)—Craig Coal Co., 10 Park Ave., Rutherford, is having revised plans prepared for a 2 story, 50 x 120 ft. garage and repair shop, etc., on Morton St. here. Estimated cost $40,000. L. B. Huesman and J. Dynes, 13 Orient Way, Rutherford, Archts. Noted Apr. 2.

N. J., Hackensack—Standard Oil Co. of New Jersey, M. Lindsay, 26 Broadway, New York, N. Y., awarded contract for a 1 story, 115 x 120 ft. garage, 50 x 80 ft. warehouse and 26 x 50 ft. pump house. Estimated cost $150,000. Noted Dec. 25.

N. J., Jersey City—Montgomery Cylinder & Grinding Co., 678 Montgomery St., had plans prepared for remodeling auto engine plant at Tonnelle Ave. and Allen St. Estimated cost $40,000. O. L. Wutzdorff, 147 Summit Ave., Union City, Archt. Noted Mar. 19.

N. J., Newark—New Jersey Bell Telephone Co., 540 Broad St., will receive bids about May 15 for the construction of a 6 story garage and warehouse at Loretta Ave. and Fabyan Pl. Estimated cost $750,000. Voorhees, Gmelin & Walker, 101 Park Ave., New York, Archts. Noted Mar. 26.

N. J., Passaic—Jersey City and Nutley Bus Co. (Kruger Bros.), 537 Franklin Ave., plans the construction of a garage. Estimated cost $150,000. Architect not announced.

N. J., Paterson—Lee & Heuitt, 152 Market St., Archts., will receive bids about May 15 for the construction of a 2 story factory for J. S. Royal, c/o Archts. Estimated cost $40,000. Noted Jan. 15.

N. Y., Jamaica—Cord Meyer Development Co., 108-16 Queens Blvd., Forest Hills, is having preliminary plans prepared for the construction of a 100 x 252 ft. service garage at 68th Rd. and East Yellowstone St. Estimated cost $100,000. I. Engelhard, c/o owner, Archt.

N. Y., Long Island City—Dept. of Water, Gas & Electricity, Municipal Bldg., New York, plans the construction of a 2 story, 52 x 150 ft. shop, etc., at Dryer and Packard Sts. Estimated cost to exceed $50,000. D. Campbell, c/o owner, Archt.

N. Y., Naponach—Dept. of Correction, State Capitol, Albany, awarded contract for the construction of an industrial shop and warehouse at State Institution for Defective Delinquents here. $201,400. Noted Mar. 5.

N. Y., New York—Barrow Street Corp., S. O'Keefe, Pres., 347 Madison Ave., plans the construction of a service garage at 174 Christopher St. Estimated cost $275,000. N. Rotholz, 155 East 42nd St., Archt.

N. Y., New York—S. Cincelli, 2393 Arthur St., is having sketches made for the construction of a 1 story, 90 x 119 ft. service garage at Hoffman and 184th Sts. Estimated cost $40,000. M. W. DelGaudio, 545 5th Ave., Archt.

N. Y., New York—Consolidated Gas Co., 4 Irving Pl., postponed construction of a 1 story, 62 x 201 ft. service garage and repair shop at 1160 York Ave. Estimated cost $350,000. Indefinite when contract will be awarded. Noted Mar. 5.

N. Y., New York—Spear & Co., 225 5th Ave., awarded contract for the construction of a garage and workshop at 524 West 23rd St. Estimated cost $450,000. Noted Jan. 29.

N. Y., New York—J. Vanek, 46 Lee Ave., Yonkers, is having sketches made for the construction of a service garage at Corlear Ave. and West 238th St. Estimated cost $40,000. E. R. Kane, 1044 East Tremont Ave., Archt.

N. Y., New York—Webster Auto Wrecking Co., B. Cohen, Pres., Carter Ave. and 174th St., is having sketches made for the construction of a garage and repair shop. Estimated cost $40,000. W. I. Hohauser, 17 West 44th St., Archt.

N. Y., Tonawanda—Lake Erie Engineering Corp., 268 Perry St., Buffalo, will soon award contract for the construction of a 1 story, 115 x 500 ft. foundry and machine shop on Woodward Ave. here. Estimated cost $80,000. N. H. Sturdy, Chamber of Commerce Bldg., Engr.

Pa., Pittsburgh—D. J. Rex Box Co., Boyd and Locust Sts., manufacturers of paper boxes, awarded contract for the construction of a factory. Estimated cost $40,000.

Pa., Ridgway—Elk Tanning Co., N. B. Norton, awarded contract for a 1 story, 50 x 160 and 74 x 100 ft. sole cutting building and warehouse. Private plans.

R. I., Newport—Bureau of Yards & Docks, Navy Dept., received lowest bid for extension to assembly building from J. R. and J. A. Whelan, 135 Pelham St. $64,000. Spec. 6437.

S. D., Aberdeen—Deere & Webber Co., G. P. Schutz, V. Pres., 800 Washington Ave. N., Minneapolis, Minn., is having plans prepared for a 2 story warehouse and shop building. Estimated cost $30,000.

Wis., Neillsville — Welch Chevrolet Co., is having plans prepared for the construction of a 1 story repair and service garage. Estimated cost $25,000. Private plans.

Utah, Salt Lake City — L. Berretta and A. Mayers, are having preliminary plans prepared for the construction of a 115 x 165 ft. garage. Estimated cost $40,000. Architect not selected.

Ont., Hamilton—Anchor Cap & Closure Co., 275 Wallace Ave., Toronto, plans the construction of a manufacturing and harbor development here. Maturity indefinite.

Que., St. Lambert—J. J. Seguin Co., will soon award contract for addition to creosoting plant. Estimated cost $150,000.